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The Pork Barrel

IF PRESS REPORTS from Washington are to be credited, the President is considering ways and means of eliminating the "pork barrel." He has told the chairman of the House committee on rivers and harbors, so it is reported, that public-works expenditures should be administered by commissions, in whose charge would be placed the apportionment of lump-sum appropriations. Under the heading of public works would come the construction of public buildings, the improvement of rivers and harbors and the building of irrigation works. We sincerely trust that the report is correct and that the President will show the same zeal for this program as he did, mistakenly, for the eight-hour law. In the one course he would be as heartily commended as he was strongly condemned in the other.

A New Tax on Motor Trucks

ENGINEERS who may have been looking to New York State's special commission for guidance in determining how to tax motor trucks in proportion to the damage which they do to highways will find little to help them in the new schedule of fees submitted to Secretary of State Hugo, Dec. 29. As noted in the Engineering Record last week, page 39, the new scale of annual charges starts with a minimum of $10 for a gross weight (truck and load) of 2 tons and advances by increments of $5 per ton up to $70 for a truck of 14 tons gross weight. Above this point the rate of tax increase doubles, amounting to $10 per ton in excess of 14, plus the $70 charge. The former state tax was on a flat-rate basis of $5 per vehicle, irrespective of weight, so that after Feb. 1, the date when the new fees become operative, motor trucks will make a contribution to the upkeep of New York State highways substantially greater than they have in the past. At the public hearings on the schedule much time was devoted to discussion of size of truck, speed, total weight, weight per inch-width of tire, different types of tires, and other technical subjects. This was to have been expected, for the special commission was specifically directed to base its schedule upon "the time and extent of their [the motor trucks'] use of the public highways and the relative wear and tear of the public highways by reason of their use thereon." This was a big task—an impossible one, according to certain motor-truck men, but the commission offers no explanation of how "time and extent of use" and "wear and tear" entered into the grading of the charges it has fixed. Moreover, the report makes no mention of tires and springs, nor of trailers. Considering the discussion which preceded its promulgation, the report and the schedule are distinctly disappointing.

Export Trade

SO MUCH has been said in these columns about the stabilizing influence of export trade and the consequent effect on our economic life, that no excuse is needed for referring again to the vicissitudes attending upon the passage of the Webb Bill through Congress. That measure, as the readers of this journal know, would allow competing firms to combine for the extension of foreign trade. The bill has passed the House and is now in the hands of the Senate committee on interstate commerce. The House, however, added two amendments, one of which would vitiate the measure and defeat its purpose. That amendment provides that an export association may not engage in "trading in or marketing" within the United States. This clause was designed as a precaution, additional to the Sherman and Clayton acts, against restraint of domestic trade, but it would operate, if enacted, to prevent the export association *from buying the very goods it is organized to export.* Unless this clause fails in the conference, provided, as is hoped, that the Senate committee will not report it favorably, the measure might just as well not be passed. It is exceedingly important to the welfare of the small manufacturer who cannot by himself engage extensively in foreign-trade promotion that export trade combinations be made legal.

Military Engineering on the Border

IN his account of what the 22d New York Engineers did during their half-year of service on the Mexican border, the first part of which appears as the leading article in this issue, Lieut. C. E. Bregenzer describes the varied services which military engineers are called upon to perform. Water was the first big problem, but at McAllen, Tex., unlike the case of the mobilization camp at Beekman, N. Y., it was a question of getting rid of water rather than of securing it, and the engineers were in great demand. Then there were manifold duties in connection with the camp water supply, roads, bridges, sanitation, trench work, and the building of mess shacks, hospitals and other structures. In the second installment of the article, to appear next week, Lieutenant Bregenzer suggests the advantages to be gained by a more extensive use of contractors' plant and equipment in military-engineering work. The military engineer of the old school is prone to rely exclusively

on hand labor. Quicker and better results can often be secured by the judicious use of mechanical equipment. This view is supported by H. G. Wells, the noted English author, who says in the New York *Times* of Jan. 7: "The decisive factor in the sort of war we [the English] are now waging is the production and right use of mechanical material. . . . The disposition of the military expert is still to think too little of machinery and to demand too much of men."

American Society's Valuation Report a Praiseworthy Document

CREDITABLE indeed is the adjustment of the depreciation controversy in the new report of the valuation committee of the American Society of Civil Engineers. The committee's own abstract of the report is published on page 59 of this issue. When the storm of protest broke three years ago over the first report, its center was the treatment of depreciation. The impression made was that the committee failed utterly to make any distinction between kinds of utilities, and accepted the view of the so-called public side, that accrued depreciation must in all cases be deducted to satisfy the courts, regardless of past regulation or the lack of it, of the impossibility or undesirability of maintaining property in 100-per cent condition, and of the evident confiscation in many cases of a part of the property by the deduction. A brand new accounting method, the "equal-annual-payment" method, was introduced, and pages and tables were devoted to its exploitation, without, however, convincing many readers of any advantages of the method over more easily understood systems. The trouble seemed to be fundamental. The report was written from the waterworks angle, with little regard for the very different conditions controlling railroad valuations. The three new appointees, however, were known to have the railroad point of view; hence the expectation of a lively controversy in the committee.

Both sides, nevertheless, have emerged from the fray with honor. Neither is decisively defeated. Nor yet has there been ignominious compromise such as would have resulted in an evasive and meaningless document. The forty-eight meetings and thirteen volumes of correspondence testify to the painstaking efforts. And as the report is read the fact is revealed that both sides have retained the essentials of their cherished views. The equal-annual-payment method, under a new name, the "compound-interest" method, is shown to be logical and superior to other methods for properties or items requiring accumulating funds to take care of final renewals. It is shown to be desirable where regulation has allowed or is allowing an annual charge for a renewal fund, or where, as in the case of a few large items of plant, safety requires provision in advance for their renewal. The committee presents substantial argument for deducting depreciation from the rate base under such conditions, crediting back such money as is found in public service, either as a separate fund or as additions to plant. This accords with the committee's original views as applied to such utilities as waterworks, subject to wide fluctuations in renewal demands. On the other hand, the committee recognizes the different conditions applying to railroads, because of the uniformity of their annual renewals and the absence of any provision or need for provision for accumulating funds. Therefore it exempts the railroads from depreciation deductions in rate cases, and meets the railroad view that renewals should be treated simply as a form of maintenance.

The success of the committee's members in adjusting their views is attributable to the admirable analysis of the fundamentals of depreciation. The first report plunged into the intricacies of depreciation accounting after barely a page devoted to fundamentals. The new version devotes fifteen pages to the fundamentals, and by its clear analysis of the bearing on the problem of the character of the utility, its parts and the regulation under which it is operated, in conjunction with those three happy terms, *decretion* (the cause), *accounting depreciation* (the record), and *depreciation of valuation* (the amount sought), prepares the reader to comprehend and approve the favored accounting method with comparatively little explanation.

This journal has been of a somewhat different opinion regarding the deduction of depreciation. It has felt that, except in the case of properties having very large items of plant, such as waterworks pumping stations, which could not be renewed except by renewal funds carried many years, it need not concern the public whether the owners elected to hold their renewal funds intact, invest them in plant or distribute them and make up the deficit by foregoing dividends when the renewals became due. It concedes, however, that this method is not altogether safe, and with the deduction of depreciation based squarely on whether depreciation allowances are or ought to be allowed, it sees no hardship in the committee's proposition.

Not only the depreciation section but practically the entire report has been rewritten and rearranged. In part this has been merely to clarify the views previously advanced; in part, to bring the discussion abreast of developments of the last three years. The valuation of land, for instance, has been debated many times in that period, due mainly to the many interpretations of the Minnesota rate decision. The railroads have not had signal success, because they appear to be trying to get, under another guise, what they were denied by Justice Hughes. The state commissions wish to strike off everything except the naked normal value. The committee finds the allowance of all real items of cost, including the compulsory feature, severance damages and the cost of acquisition, compatible with the Minnesota decision, but—and here it departs from the railroad view—it rejects the theory of an additional value attaching to the property because of its higher use. The Engineering Record is in hearty accord with the committee's entire land discussion.

The whole report leaves little to be desired, and the Engineering Record hopes it will be accepted by the society at an early date.

Compensation of Engineers

TWO YEARS AGO, when the special committee on compensation of engineers made its second progress report to the American Society of Civil Engineers, considerable information in addition to that of the first report was presented, and hopes were raised that more representative figures were to be obtained by a thorough canvass of the army of non-members of the society in the employ of large corporations and governmental organizations. These hopes are scarcely realized by the addition of 1582 replies, or an increase of 33 per cent over those previously reported. The committee thinks the additions have not materially affected the averages, but surely there is ground for contention that reductions of more than 10 per cent are material.

Looking at the latest diagrams one sees at once that the irregularities have not been materially reduced. In Diagrams 1 and 2 (see page 68), for instance, there is no logic in the peaks for the average curve at 18, 25, 29 and 31 years. Likewise who can explain why in Diagram 3 the two curves come almost together at the fifth period? Or why in Diagram 4 the contractors' curve drops violently at the fifth period and then immediately recovers, the railroad curve following suit five years later? Obviously the only answer is insufficiency of data and the domination of a few high incomes.

This domination shows plainly in Diagram 1. For the first 25 years it is not so marked, but even here the bumps in the average curve match those in the maximum. For example, with a peak in the maximum at 2 years the average is $70 or 5 per cent above the mean between 1 and 3 years; at 10 years, another peak, it is $152 or 6 per cent above; while at 18 years, a high peak, it is $775 or 17 per cent above. Beyond 25 years, as the number of replies in each group diminishes, the irregularities increase.

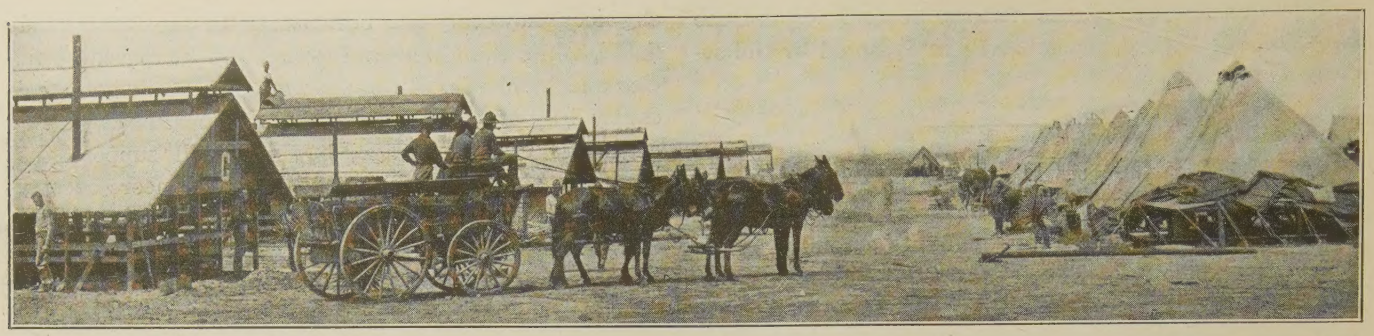
Much interesting information can be gleaned from a comparison of these diagrams with the corresponding ones of two years ago (see the Engineering Record of Jan. 30, 1915, page 139), even though the committee does not regard the changes as substantial. In the early years, where there are no extraordinary maximums, the reductions are small, though positive; but at 18 years, when the first $150,000 income is reached, 51 new replies reduce the average $387, and at 29 years, another peak, 18 new replies cause a reduction of $1,026, or more than 10 per cent. An interesting sidelight on this diagram is the raising of the 20-year average by $62—explained probably by the committee's discovery of a new high man outside of the society at $57,500, ousting a mere $25,000 engineer.

Diagram 4 and its counterpart of two years ago furnish further evidence of the inadequacy of the data. Of the 1582 new replies 25 are contractors—a reasonable increase in the smallest group. Only one new consulting engineer, however, has been added to the 619 already listed, while the lower-paid groups are increased by fifties and hundreds. In other words, the committee evidently had practically all of the prosperous consulting engineers two years ago, but who will suppose that there are almost as many consulting engineers as engineering employees of municipalities or of railroads?

The truth is in all probability that the rank and file of those following civil engineering have not yet come to the committee's attention. The committee canvassed fifteen local engineering organizations. Probably the vast majority of engineers belong to no society whatever. The committee states that it could not get the necessary co-operation to list the men in large corporations or public organizations. Was that universally true? Could it not profitably have included a few such groups? For example, the annual reports of the New York State Engineer publish the compensation of all members of the department. A hasty census by this journal of the engineers reported in 1915 in the Eastern District showed 253 men following engineering, from deputy state engineer to chainman. Their average compensation was $1,775. Only eight were up to the committee's average of $3,986. Of these 253 men only 44 were found in the membership list of the Society, and they averaged $2,857, leaving an average of $1,547 for the other 209. This suggests the unreliability of returns mainly from members of the society.

The committee suggests that many of those who have commented on its previous reports were men doomed to failure in any profession. Judged by the standing attained by the members of the committee, that is probably true. For that reason it may be unfortunate that the committee was not made up in part of men of lower rank. Executive and administrative ability is found in comparatively few. Many who have little of it, and can never be powers in the engineering profession, are nevertheless industrious, faithful, technically sound and reliable for important detail work. Are they failures? And do they fare as well as men of similar characteristics in other walks of life? Not a few of them believe they do not, and it is harsh of the committee to say that their comments should be given little weight.

It is further suggested that the eagerness of young men to adopt the civil-engineering profession is due to the quickness with which they reach a self-sustaining basis. May it not be due in part to an exaggerated idea of the fruits of engineering, and will there not be an inrush of young men who read that the average compensation of civil engineers is $3,986 per year? The Engineering Record would like to believe that the figure is correct, but is far from convinced that it is even $3,000. Until a far greater number of the untitled employees of large organizations are included in the diagrams and the kinks are straightened out it will be hard to believe that the curves are representative and trustworthy. Therefore it is the hope of this journal that the committee will withdraw the report and seek new ways and means to record these many missing members of the profession.



CAMP OF ENGINEER TROOPS AT THE BORDER

On the Mexican Border with the 22d Engineers

Part I—Drainage Was the First Problem Which the Troops Faced—Five Bridges Built — Water Supply Installed — Mexican Labor Employed on Some Work

By C. E. BREGENZER
First Lieutenant, 22d New York Engineers, N. G. U. S.

PREPARED and hardened by strenuous work in connection with the installation of water supply, road work and other engineering duties at the mobilization camp at Beekman, N. Y., described in the Engineering Record of July 1, page 3, the first battalion of the 22d New York Engineers entrained for the Mexican border on July 12, followed two days later by the second battalion. The first engineering duty required was drainage work, for the arrival of the regiment was coincident with the beginning of the rainy season, when a torrential downpour registering a 2-in. precipitation in about 18 hours caused many washouts.

DRAINAGE THE FIRST PROBLEM

Located at the base of a slope, the engineer camp was subject to inundation from the back waters of the Rio Grande. The ground does not absorb water, but is adobe, similar to the gumbo flats of Missouri. While the rain was pouring, the officers, equipped with rubber boots and raincoats, went out to determine natural water channels, in order to avoid flood recurrences. Levels were run the next day and a 2 x 3-ft. drainage ditch was staked out and dug along the northern part of the camp.

In places where the ground profile prohibited depth of ditch, dikes were constructed. Laterals were also dug along the company, regimental and headquarters streets, and all tents were ditched. The ditching, done by the men, saved the camp from flood troubles for the time being, but the heavy, continuous rains soon caused the water to back up in the valley, making it necessary to abandon the camp site.

One of the worst sufferers from the rains was the 12th New York Infantry. A large lake formed at the western end, or foot, of the company streets, flooding many of the tents and rendering the streets unfit for travel. Relief was first sought by drilling a hole with a well-drilling rig near the center of the lake, with the hope of penetrating a water-absorbing stratum; but beyond filling the hole, no results were achieved.

By a process of elimination, the officers of the regiment finally decided to dig a drainage ditch. At the foot of a long slope, with hardly perceptible fall, is located one of the main irrigation canals. Permission was granted to break through this canal. Requests were made to the engineers for transits and levels, and a detail of officers and men was sent. The measured distance from the edge of the lake to the center of the irrigation canal was 1475 ft., and profile readings indicated that a grade of 0.3 per cent was possible, draining the deepest part of the lake, about 2.5 ft. Grade stakes were set every 50 ft. The men of the 12th Infantry were furnished with picks, shovels and spades, and began the heavy task of digging the ditch, which ranged from 2 to 9 ft. in depth, except the canal dike, where it was 14 ft. An average bottom width of 2 ft., with 1 on 1 slopes, was maintained. According to military custom, where men are plenty and quick results are sought the men were divided into two working parties, each working and resting thirty minutes alternately.

PICK-AND-SHOVEL WORK EXHAUSTING

Without intended criticism, as the men worked hard and willingly, it became apparent to one familiar with excavation methods that this body of men was not responsible for any of the pipe lines or sewer trenches in our cities. They were speedily exhausted and achieved poor results, simply because they did not know how to use a pick and a shovel to advantage. It became necessary for the engineer officers to instruct them and to explain such matters as tool ratios, proper spacing to prevent injury and finally the necessity of benching. The same conditions obtained among engineer soldiers, and it required some time to instruct them. Once they acquired the knack, their native intelligence speedily made them efficient.

About 600 ft. of this drainage ditch, adjoining the irrigation canal, was let to a Mexican contractor, who did the work with Fresno scrapers, mule teams and plows. Experiments were made to break through the dike of the canal with explosives. Trotol gelatine was used, but the action of this explosive is upward, and it gases too rapidly for effective work. Blasting powder would have handled the situation. With the combined

methods described the whole work was completed in about a week.

As the drainage ditch bisected the camps of the 12th Infantry and 4th Ambulance Company, it was necessary to bridge it with five bridges to establish intercommunication. They varied from 12 to 36 ft. in span, and were of the beam-and-trestle type, 18-ft. roadway, and were formed of 6 x 6-in. stringers, spaced on 2-ft. centers, resting on three 6 x 6-in. sills supported by cribbing. The floors consisted of 2 x 10-in. planks; 6 x 6-in. guard rails were added, as well as handrails, the latter constructed of 2 x 4-in. lumber. One of these bridges was built between 8 and 10:30 p. m., by lantern

ENGINEER SOLDIERS WERE DETAILED TO LAY WATER PIPE

light, the work being done by a detail of twelve engineer soldiers.

The trestle bridge consisted of three bays, 12 ft. to the span, resting on two 6 x 6-in. sills and two framed trestles of 8 x 8-in. timbers, made up of two plumb and two batter posts. The stringers were formed of 3 x 10-in. timbers spaced on 18-in. centers, with 2 x 10-in. planking for the floor.

Data Gathered on Existing Bridges

A bridge detail, consisting of master engineer sergeants and privates, was sent out to gather data in reference to all types of railroad and highway bridge structures in that section of the border under control of the New York division. Sheets were prepared showing stress analyses, type of bridge and materials of construction.

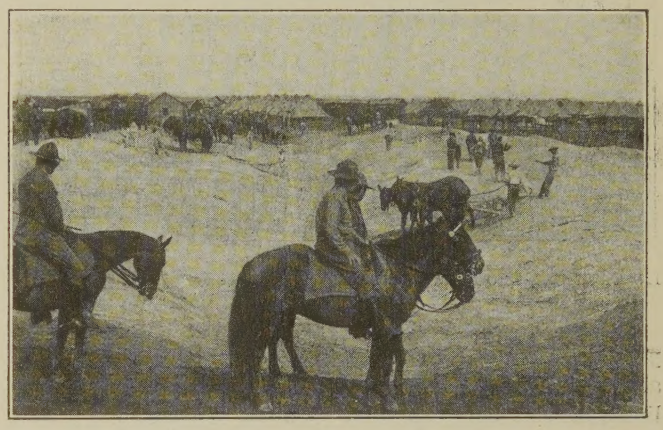
Most of the highway bridges were very light, the stringers usually consisting of 2 x 10-in. planks, with the same dimension for flooring. Some of these, especially along the main line of traffic, had to be entirely rebuilt, and nearly all had to be stiffened to accommodate the motor-truck traffic.

Concrete finds little application in bridge or other army construction. Sand is expensive and a little too fine for good results. The nearest stone outcrops were about 18 miles north and west of McAllen. Sam Fordyce, about equidistant, has some very fine gravel pits.

Many of the culverts are of the corrugated, galvanized-iron type, but lack proper covering. On the West McAllen and Hidalgo roads these had to be covered prior to the maneuvers held at Hidalgo. The bridges on these roads had also to be rebuilt, repaired or stiffened in order to accommodate artillery and supply trains. One company of engineers was assigned to a road, and the work was completed in twelve working hours. The mounted section of engineers did good service here, preceding the main body, with wagon escort, and leaving necessary timbers at sites. They also handled the lighter repair work.

Tactical Problem Worked Out

Two maneuvers were held at Hidalgo, located on the Rio Grande and opposite the Mexican town of Reynosa. The objective of the tactical problem was to effect a theoretical crossing of the river, the banks of which are rather friable and abrupt. The river is about 500 ft. wide and has a current of approximately 7 miles an hour. The offensive force consisted of a reinforced brigade, with all arms of the service represented, a company of engineers being detailed to act with the advance. On the capture of Hidalgo, they carried out the practical part of the theoretical crossing by constructing a fascine raft made from willows, which grow in profusion. The fascines were bundled in chokers, hurriedly constructed of poles. The raft proved successful, having sufficient bearing power to support ten men.



TO UNWATER THE 12TH INFANTRY CAMP A DRAINAGE DITCH 1475 FEET LONG WAS EXCAVATED

Water Supply

One of the important problems at McAllen, as at Camp Whitman, New York, was the water supply for the various units encamped there. These consisted of Division Headquarters, Signal Corps, one ambulance company, field and base hospitals, 7th, 12th and 71st Regiments of Infantry, 1st Regiment of Cavalry, Squadron A, 1st and 2d Regiments of Field Artillery and a regiment of engineers.

The only available source of water supply is from the city waterworks, supplying a town of about 2000 inhabitants. Few of the Mexican residents of the town use this water. The system had to be expanded to serve a population of 10,000, a problem which was solved without entailing any suffering due to lack of water.

McAllen receives its water from two wells, driven to a depth of 98 ft. Underlying the town site for a width of about 600 ft. there is a gravel intrusion from the Rio Grande, the waters of which seep through. The

wells are equipped with deep well-pump heads, from which the water is delivered to a standpipe 85 ft. high, having a capacity of 100,000 gal. At first the water was unpleasant to the taste, as is common in alkali regions, especially when warm, but was pronounced wholesome by the medical authorities. It contained an excess of magnesia salts, but the men readily learned the neutralizing effects of lemons, and this simple lesson in chemistry found wide application.

At the time the engineers arrived at McAllen the units enumerated were supplied from a 2-in. pipe line connected to the city mains. This line was located along the regimental streets, a ¾-in. riser and bibb being

IN TACTICAL-PROBLEM WORK THE ENGINEERS HAD TO BUILD MANY BRIDGES

provided for each company kitchen. The arrivals of additional troops and stock soon taxed this line to the limit, and as showers were planned, a new supply line was decided upon. One of the engineer officers was detailed to headquarters to supervise this work.

The new extension called for a 6-in. line from the pumping station to the first company street of the 7th Regiment, thence parallel to this street to its end, there a reduction to a 4-in. line to a point at the south end of the 71st Regiment camp, then a 3-in. line for the 1st and 2d Field Artillery and Squadron A. Traverse surveys were made from the new location of the 1st Cavalry and engineer camps, and the calculated closing line of this area became the location of a 6-in. line 2800 ft. long between the engineer camp and the end of the 6-in. line at the 7th Regiment. The projected lines were staked out, but no profile was run, as the ground has an even surface.

EXPERIENCE WITH MEXICAN LABOR

The contract for excavating the pipe trenches was let to an American contractor, who employed Mexican labor. The padrone system obtains, the laborers receiving $1 per day. They were a motley and picturesque crowd, ranging from grizzled old men to boys, many of them only shod with sandals. They all have the mañana habit, and it required a clever foreman to get a day's work out of them. The common method is to give them station work, a task of so many hundred feet, upon completion of which they may go for the day. Some thirty of these Mexicans were assigned to an engineer officer on a piece of work, the completion of which was urgent, but as soon as their padrone turned his back they began leaning on their picks and shovels. None too familiar with vernacular expletives, he simply ordered them out of the trenches and substituted engineer soldiers. In the belief that they had lost their jobs, they soon returned to work with considerable vigor. In their work they used pick mattocks and long-handled shovels.

During the progress of excavation work on the trenches, pipe was distributed along the side by motor trucks. At spots determined beforehand, tees, unions, gate valves and expansion joints were left, to be fitted in as the pipe gangs advanced. Engineer soldiers were detailed to do this pipe work, their tools consisting of Stillson wrenches, chain tongs and ball peen hammers, the latter used mostly for loosening tight thread guards. Here, as at other times, it developed that practically all trades were represented in the Engineer Corps. There were at least a dozen expert pipefitters, with experience on either steam or water lines. They handled the work well, one detail of fourteen men laying more than 2800 ft. of 4-in. wrought-iron threaded pipe in one working day. It must be remembered that the working day had to be shortened, as at times the thermometer rose to 145 deg. Fahr. The usual working hours were from 7:30 to 10:30 a. m. and from 2 to 4:30 p. m. A pipe-fitting shop was rigged up at the pumping station, and consisted of a pipe vise and a hand-threading machine. The engineer detail stationed here cut and threaded all pipe used for fillers and all fittings. A pipe-fitting arrangement on the combat wagons would have saved some time on this work.

ONE SHOWER BATH PER BATTALION

Three ten-head shower baths were allowed for each regiment, one to each battalion. It developed in course of inquiry that each unit had plumbers and pipefitters, so the engineer officer simply made a dimension sketch on the inside cover of the valve control box, together with the bill of materials required. The pipe and fittings were then drawn by the regimental supply officer and placed by men of the regiment. An inspection revealed very workmanlike execution of the sketch. About 2000 ft. of the line, extending from the 7th Regiment to the engineer camp, was 6-in. cast-iron bell-and-spigot pipe; the remainder wrought-iron, threaded. On the threaded pipe no white or red lead or other compound was used, as the pipe rusted in very quickly, and no leaks developed.

The laying of the lines to the Engineer and 1st Cavalry camps was let, the work being done by Mexican labor, on the station plan. It is said that the trenches were dug and the pipe laid and covered for a trifle over 3 cents per foot. An engineer officer was detailed as inspector on this work. This new pipe line and the drilling of a third well, near the pumping station, relieved any existing dearth of water.

Outside of detailed mapping of extant lines, no water-supply work was required of the Engineer Corps at Mission and Pharr, where the remaining units of the

New York Division were encamped. At both these places the source of water supply is from canals on the irrigation system, supplied by pumping stations on the Rio Grande. From the canals the water is pumped into tanks and distributed by gravity. Pharr has sedimentation basins.

WATER FOR "HIKING" CIRCUIT

Water-supply work was further required at La Gloria and Laguna Seca, both points on the "hiking" circuit, where troops camped while making the prescribed ten-day march under full equipment. La Gloria, located 22 miles northwest of McAllen, in the "hinterland," was also chosen as a site for the artillery and infantry rifle ranges. This place is not a town or hamlet, as one may be led to infer, but simply a windmill. It had been a Mexican bandit rendezvous, and the marks

IMPROVISED CHOKE FOR MAKING FASCINES FOR RAFT

of their hurried exit from the Rangers can still be seen in bullets embedded in the windmill structure.

A company of engineers was detailed to this place to install a power-pumping plant and storage tank. The prime mover was represented by a portable 4-hp. contractor's gasoline engine and a deep well-pump head, both of somewhat remote pattern.

It required a two-day march to reach this place. On arrival the windmill was repaired and tests were made as to capacity The mill developed about 1½ gal. per minute under average wind conditions. Four machinists were found in the company who had had gasoline-engine experience and they undertook to get the engine in running order. It was found that the compression was good, but some essentials were lacking, among them batteries, spark coil, spark plug, gasoline tank, oil and gasoline. The valves needed grinding and the spark-timing device repairing. An estimate was made of the articles required, also necessary pipe fittings, pump rods and tank, and an officer was dispatched to Sterling's Ranch to order them. In the meantime, an old water hole, used for storage, was cleaned out, as it proved a prolific breeding place for mosquitoes. A timber head of 6 x 6-in. lumber was also constructed in the windmill structure for mounting the pump jack. After twenty-two working hours the engine was repaired and running, and was belted to the pump jack. The stroke of the pump rods was increased from 11 to 19½ in., and the power-equipped well developed 10 gal. per minute. An 1800-gal. tank was installed, the casing lengthened and connected up. A thatch roof was also erected over the tank. Although this water came from a rock foundation and a depth of 120 ft. it was not very cool and had a very salty taste.

To those accustomed to calculating water supply on high unit figures it may be of interest to note that at one time a battery of artillery, consisting of 150 men, a company of infantry, 90 men, and a detail of 60 engineers, together with 90 horses, used this well as their sole source of water supply for several days. A guard was placed at the tank valve, and such luxuries as washing and shaving were dispensed with.

The seven windmills at Laguna Seca were badly damaged by the West Indian hurricanes, which blew at the rate of 80 miles an hour. An engineer detail of seven men was sent out in a motor truck to make hurried repairs. On arrival they found that several repair parts were essential, and water as well. They installed a rope drive, using the jacked-up rear wheels of the motor truck as a prime mover, which proved successful.

On account of the uncertainty of finding suitable water when out on detached work, the engineer troops took a tank sprinkling wagon along with them. This saved much time, especially in choosing a suitable camp site. *(To be concluded)*

Prof. Whipple Reports on New York's Proposed Garbage-Reduction Works

Expert Predicts That Plant with 2000 Tons Daily Capacity Will Be a Nuisance at Times— Staten Island Site Not Best, He Says

THAT Staten Island is not the best site, from the sanitary standpoint, for New York City's large garbage-reduction plant, which has been a storm center of protest and litigation since the contract for its construction and operation for a five-year term was awarded last April, is the opinion expressed by Prof. George C. Whipple of Harvard University, consulting engineer of the firm of Hazen, Whipple & Fuller, in a report submitted last month to Linsly R. Williams, deputy commissioner of the New York State Department of Health. While the proposed plant, which is to have a daily capacity of at least 2000 tons, will constitute no menace to health, according to Professor Whipple, it will, at times, be a nuisance within the meaning of the Public Health Law and the penal statutes. Odors may be expected periodically from the works themselves and also from the scows which will deliver the garbage from dumps along the city's water front via New York Harbor and the Kill van Kull. Professor Whipple believes that the Cobwell process of reduction, which it is planned to install at the Staten Island plant, "is the best method now known and available for the disposal of the garbage of the City of New York," but he contends that the plant should be located either on Riker's Island, in the East River, or on Barren Island, in Jamaica Bay. The Riker's Island site was the one originally recommended by Commissioner John T. Fetherston of the Department of Street Cleaning, but so strong was the opposition to it by local interests that the project had to be abandoned. Professor Whipple's report, from which the following extracts have been taken, deals

not only with the results of his own observation and study but also with the testimony of a host of expert witnesses given at numerous public hearings held recently.

THE NEW CONTRACT

On April 10, 1916, the city of New York made a new contract for the disposal of the garbage of the boroughs of Manhattan, Bronx and Brooklyn for a period of 5 years commencing Jan. 2, 1917. In asking for bids it was expressly stated that a plant operated under the contract could not locate within the boundaries of the Borough of Manhattan nor within the confines of Jamaica Bay. It is mutually agreed that at the expiration of the contract the city shall have the option of purchasing the plant and equipment of the contractor, and the land upon which the plant has been erected in the manner provided by law. The successful bidders were Gaffney, Gahagan & Van Etten, who assigned the contract to the Metropolitan By-Products Company, of which Mr. Van Etten is vice-president.

After much litigation the contractors obtained permission from the Building Department of the Borough of Richmond to erect a plant at Lake Island, on Fresh Kills, in the southwestern part of Staten Island, and the necessary buildings are now being constructed. Meantime the present proceedings were instigated.

COBWELL PROCESS OF REDUCTION

It is proposed to dispose of the garbage by reduction according to the Cobwell process, hitherto used only at New Bedford, Mass., Los Angeles, Cal., and at the Panama Exposition at San Francisco, and differing materially from the reduction methods heretofore used. Briefly, it consists in first subjecting the green garbage to the action of petroleum naphtha, or a low grade kerosene, in steam-jacketed closed containers, or digesters, capacity 3 to 5½ tons, in which the temperature is raised to from 170 to 196 deg. Fahr. In 12 to 16 minutes the boiling point is reached and then for 7 to 12 hours a process of dehydration goes on, during which the garbage is stirred by a mechanical agitator. The naphtha and water go off together and are separated in a condenser, the effluent water flowing to waste and the naphtha being saved for use. Surface condensers have been used heretofore, but it is proposed to use a jet condenser at Staten Island. During this digestion the garbage loses most of its moisture, 70 to 75 per cent by weight, becomes more or less broken up, while its grease becomes dissolved in the naphtha.

SECOND STAGE OF PROCESS

The second stage of the process consists of drawing off the naphtha-grease and washing the garbage with solvent two or three times to remove the remaining grease to an economical limit (all but about 1.5 per cent). The grease is separated from the naphtha in stills.

The third stage is the introduction of live steam to eliminate the naphtha, a process which requires from three-quarters to one and one-half hours, and a final drying by means of the steam jacket, the temperature of which may exceed 300 deg. Fahr. The solid portion of the garbage, retaining 6 to 7 per cent moisture, is then removed from the containers in the form of tankage, which is subsequently sifted and ground. The active process is conducted in closed digesters, but these are necessarily opened when being filled and emptied.

NEW BEDFORD PLANT

Many witnesses testified in regard to the New Bedford plant, which comprises six digesters and has a capacity of 50 to 60 tons a day. The average quantity of garbage treated per day during the past year has been about 30 tons, but at times has run well up to the capacity of the plant. The general testimony was to the effect that since the Cobwell system was introduced in August, 1915, the plant has not produced odors sufficient to cause complaint by residents living ⅓ to ½ mile away. That the plant was not odorless was admitted by all; that the odors were much less than at plants using the older methods of reduction was also admitted. The expert testimony on the character of the effluent water was conflicting.

Evidence was presented to show that flies were very numerous at this plant, but there was no evidence to show that the flies left the plant to annoy or endanger the health of persons at a distance.

The testimony gave no indication, and certainly no proof, that the New Bedford garbage plant menaced the health of neighboring citizens, or even the health of the operatives, although some of the witnesses suggested this.

LOS ANGELES PLANT

The Cobwell system has been in operation at Los Angeles since July, 1915, but in full operation only since December, 1915. The Pacific Reduction Company, which operates it, has a 10-year contract with the city. The average quantity of garbage is about 170 tons per day, the maximum about 215 tons. The nominal capacity of the plant is about 200 tons. The only testimony introduced was to the effect that while there were some odors inside of the building, these odors were not carried more than 100 ft. beyond the limits of the grounds. The effluent water from the surface condenser flows undiluted to a private sewer and discharges over rocks to the river, which often has a dry bed. It was said to be without odor, and almost without color, and that workmen are in the habit of washing their hands in it.

In 1915 a small plant was operated in the exposition grounds. This treated a small quantity of fresh garbage apparently without nuisance. The Cobwell process was used.

EXPERT TESTIMONY ANALYZED

Professor Whipple discusses in detail the testimony of the expert witnesses and draws the following inferences therefrom:

While flies would doubtless follow the garbage to the plant and even breed at the plant, they would not leave the scows or the plant in sufficient numbers or travel such distances as to cause trouble worth serious consideration to the people of Staten Island.

Under ordinary conditions the scow loads of garbage would cause no inconvenience from odors except to persons who come relatively near to them, but under

conditions of delayed collection or of hot, moist weather the odors might carry to a greater distance and be occasionally noticed on passing boats or on the shore.

Possibility of Odors

It was substantially shown, says Professor Whipple, that in the past all garbage reduction plants of large capacity have given off objectionable odors; that the relatively small plants now using the Cobwell system, while not odorless, have not given off odors which have carried far; that the principal far-carrying odors in reduction plants have been due to the use of direct tankage driers, which will not be used at Staten Island; that a large plant would naturally give off more odors than a smaller plant, and that these would carry farther. Some of the experts denied this, but gave no adequate basis for their belief. It may be fairly inferred from the testimony that while under ideal conditions the plant might be kept from emitting all except local odors, yet under the best practical working conditions the chance of odors from several different sources occurring simultaneously and combining to produce an odor that would carry for a considerable distance was one that cannot be denied and should be regarded as an objection to the location. Such odors, however, would probably not extend beyond the limits of the Fresh Kill marshes and would not reach the principal settlements on the island.

Effect on Health

Evidence that the odors from the plant would injure the health of persons residing within their range, by affecting the appetite, causing loss of sleep and general mental discomfort, was weak and inconclusive.

Because of the noisome and unwholesome character of garbage, especially in hot weather and with delayed collection, and because of the odors likely to be given off from the plant, and because of waste products discharged into the water, it was contended that the process of manufacture should be regarded as noisome and one not suitable to be conducted near a highway or route of travel, and that operation of the plant will therefore violate the penal law. The evidence on this point was conflicting, but a fair inference, according to Professor Whipple, is that the point was well taken.

Staten Island Site Not Best

On the expiration of the contract the city has the option of purchasing the plant. Should the site be a disadvantageous one from the city's standpoint, the purchase might not be made. Consequently there would be a natural tendency for the contractor to fail to keep up repairs in order to secure the greatest possible profit before the contract expired. If not purchased by the city, or the contract renewed, the plant would naturally be abandoned or used for some other purpose.

Without pretending to have made a thorough investigation of this matter, says Professor Whipple, it would appear from the evidence that the site is not the best that can be selected for the plant which will be needed by New York City in the future. It was shown by witnesses that the incineration of the garbage from the three boroughs would be impracticable because of expense. Practically all of the experts said that the Cobwell process is the best now known. Assuming that the Cobwell system is the one best adapted to the disposal of the garbage of the city, there would be manifest economies for the city to own its own works and combine them with an incinerator for destroying the city's rubbish, in order that the heat produced by incineration might be used to furnish power for the reduction process. The experts said that a city-owned plant would be kept in a more sanitary condition than that of a private company because of not being obliged to yield to profit.

Riker's Island Site Preferred

To locate an incinerator at Fresh Kills sufficient to destroy the rubbish of New York City would be impracticable and most undesirable. Such a combined plant would be better placed on either Riker's Island or Barren Island. On the other hand, to keep such a plant as that being erected at Fresh Kills in operation for only five years would involve a heavy final depreciation and require that large profits be made during the life of the contract. To locate the Cobwell system on boats, as was suggested by some of the experts, would be impracticable.

Under these conditions it is doubtful, according to Professor Whipple, if the penalty clauses in the contract giving the Commissioner of Street Cleaning power to insist on a satisfactory manipulation of the plant would operate to prevent the creation of a nuisance.

Conclusions

As a result of the investigation Professor Whipple has reached the following conclusions:

1. The transportation of garbage in scows from the boroughs of Manhattan, Bronx and Brooklyn to Fresh Kills, Staten Island, and its disposal there by the Cobwell process of reduction as proposed under the contract will not, in any appreciable or material way, affect the security of life or endanger the health of the people of Staten Island.

2. The garbage-disposal works will, by reason of odors emitted at certain times, be a nuisance (within the meaning of Section 6 of the Public Health Law and Section 1530 of the Penal Law) within the low-lying part of Staten Island which may be described as the Fresh Kill Marshes, including the village of Linoleumville, the small settlement known as Fresh Kills and certain highways; but this nuisance will not extend generally over Staten Island.

3. The transportation of garbage in scows as provided for by the contract will under certain conditions be an offense to the residents of Staten Island along the Kill van Kull and to persons on passing boats and vessels on the Kill van Kull and Arthur Kill. Garbage and waste products will also be scattered so as to litter the banks of the Fresh Kills.

4. The Cobwell reduction process is the best method now known and available for the disposal of the garbage of the city of New York.

5. From a sanitary standpoint there are other sites in New York City more suitable and satisfactory for the location of a garbage reduction plant employing the Cobwell process than the Fresh Kills site at Staten Island, namely, either Riker's Island or Barren Island.

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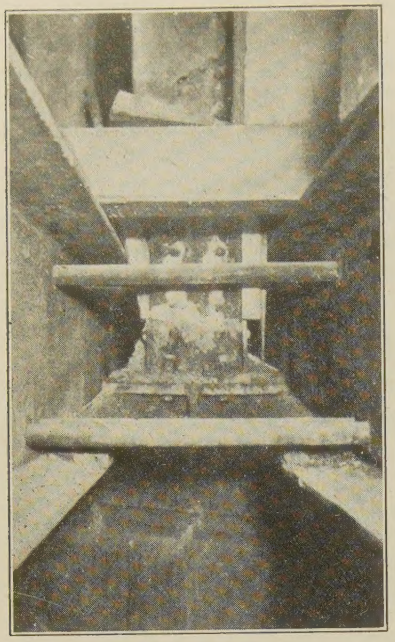
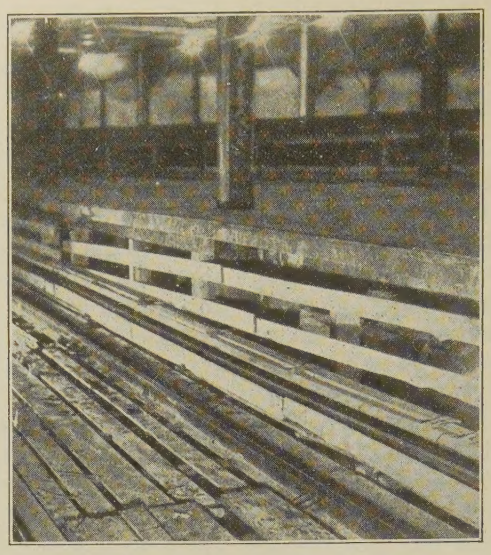
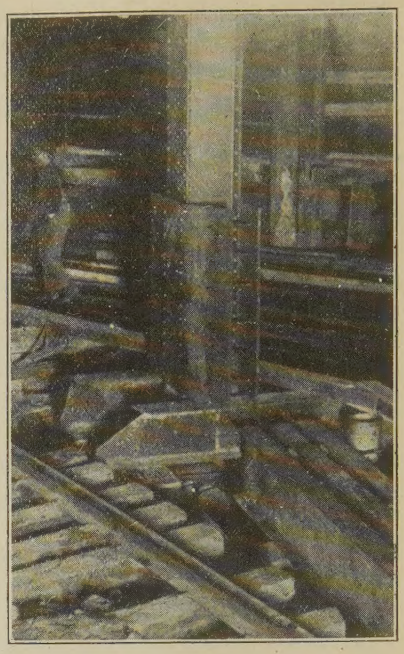




NEW METHODS FOR NEEDLING COLUMNS—PLANKS KEPT WORKMEN CLEAR OF TRACKS



Build Concrete Slab Under Busy Railroad Station to Expedite Subway Construction

Long Island Railroad Underpins Flatbush Terminal Below Track Level by Constructing Heavy Slab in Sections Without Delay to Traffic

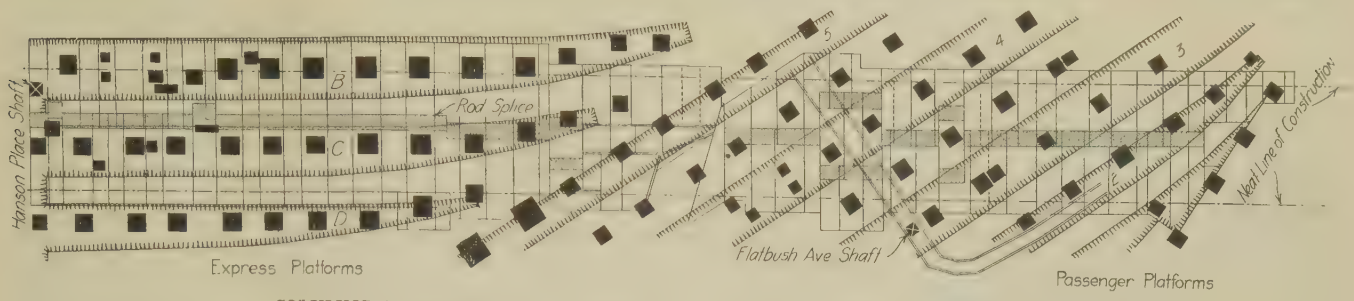
TO AVOID having its passenger platforms and tracks interfered with by construction work not directly under its control, the Long Island Railroad, under whose Flatbush Avenue terminal in Brooklyn is to be built a section of the Flatbush Avenue extension of the new subway system, has, with a special organization, built, in sections, a reinforced-concrete slab beneath its tracks and column footings for the entire length of the proposed subway within its building lines. It has also underpinned all columns liable to be affected by the subway construction. This slab will form a stiff, solid roof for the subway excavation, and will make it safe to mine under the station through the glacial drift, on which it is founded, by ordinary methods. It will also obviate extremely complicated and expensive shoring which would have been required without this preliminary work.

The earthfill within the sections of the old passenger and express platforms affected was taken out in railway cars. Shafts were sunk from Hanson Place and Flatbush Avenue, and drifts were driven beneath the tracks to give access to the excavation for the slab, which proceeded by sections and was disposed of by team or by backfilling the rebuilt platforms. Concrete was mixed at street level and spouted down to buggies on the platforms for distribution. The entire work was completed in the eight and one-half months between Feb. 17 and Oct. 31 last, without a single accident resulting in disability, and without injury to a single passenger. The time required, while two and one-half months longer than was at first planned, is considered remarkably short in view of the size and difficulty of the work, of the fact that extra work ordered greatly increased the number of columns to be shored, and in view of serious delays from strikes and other causes.

The Flatbush Avenue terminal has three levels, the street floor being occupied by the freight house, above which, on an upper level, are the freight tracks. Below the freight house, underground, is the passenger and express station. The concrete slab built occupies a strip beneath this lower level approximately 65 ft. wide by 500 ft. long. The slab will be required to carry directly and permanently the loads from all the columns within its area. As may be seen from the accompanying plan, the slab crosses the passenger tracks along a skew, and practically all the columns within its limits are staggered with reference to its center line. Both on this account, and because of its width, it was not possible to excavate and concrete strips clear across it, and it was therefore decided to excavate strips half width and splice the slab in the center for most of its length.

Work Done by Sections

Proceeding in this way, it was possible to excavate and concrete two strips on each side of a column, needle the column from them, and then excavate and concrete the strip beneath the column. The sections taken out in this way were from 150 to 400 sq. ft. in area. The splice at the middle of the slab was made between adjoining sections by lapping the reinforcing 6 ft. and concreting the lap with the second section placed. Fifty-eight column footings, the possible future loads on which range from 200 to 500 tons, are carried directly by the slab. In addition to these, 23 other columns the footings of which might be undermined by the subway



COLUMNS STAGGERED WITH REFERENCE TO SLAB NECESSITATED CENTER SPLICE

construction were underpinned. The subway structure to be built beneath this slab includes two tracks and an island station platform, and is approximately 48 ft. wide between neat lines.

Old Platforms Replaced First

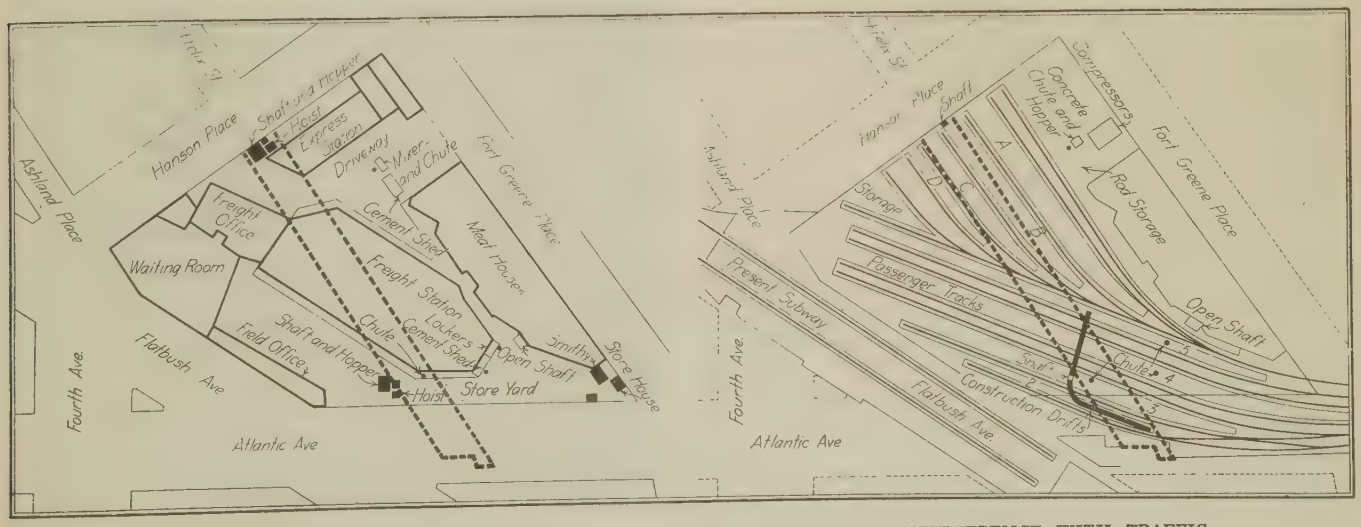
The old platforms in the Long Island station consisted of concrete side walls and a concrete deck, the space beneath which had been backfilled. The first work done was to cut out this concrete, replacing it with temporary wooden platforms, and load the spoil, together with the old backfill, into gondola cars which were run in on the Long Island tracks at night. After this had been done it was possible to operate small swivel dump cars on narrow-gage tracks beneath the platforms, and dispose of the remaining excavation without interfering with train operation. Work under platforms B, C and D, which were used only by the Adams Express Company, was simplified by handling part of the dirt up to the platform level and wheeling it along the platform in buggies. In this way, after the slab sections underneath platforms C and D had been concreted, and the platforms partly restored, they were backfilled with material taken from the slab sections under platform B.

Altogether, it was possible to arrange the work so that 4030 yd. of the excavated material was utilized as backfill. The passenger platforms, however, could not be rebuilt in this way without causing too great inconvenience to the patrons of the railroad, and they were consequently restored by building cross-walls to support the reinforced-concrete deck. Altogether, 11,760 cu. yd. of sand, boulders and gravel were excavated, of which 2200 yd. were disposed of in railway cars at the beginning of operations, leaving 5530 yd. to be taken out at the shafts and disposed of by team.

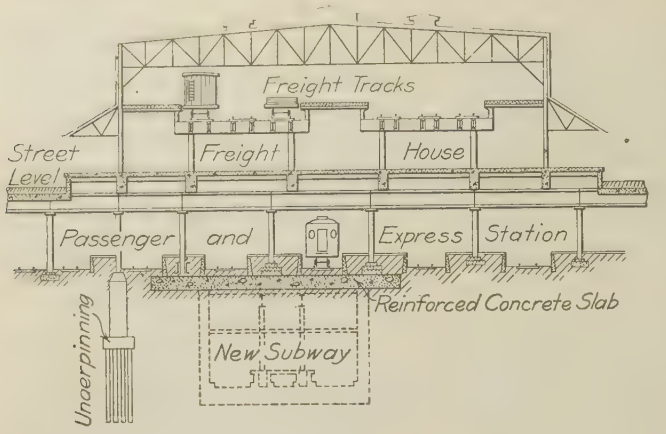
A great many boulders and a considerable yardage of hardpan were encountered in the excavation, most of this material being under the passenger platforms. As it was not possible to use explosives, the boulders and hardpan had to be drilled with air hammers and split apart with plugs and feathers. The old concrete platforms were also removed in the same way. The railway tracks were supported across the sections being excavated, and across the drifts dug to gain access to the narrow-gage tracks under the platforms, by I-beams. The blocking was left in place under the tracks until the slab had been practically completed. It was then removed and the ballast replaced and tamped under the ties.

Needling Columns Difficult

The columns rested on cast-iron bases and concrete pedestals, the bottoms of most of the footings being less than 2 ft. above the elevation of the top of the slab. It was found economical to save most of the old pedestals, but there was not sufficient headroom to insert beneath them needles capable of supporting the entire load. They were therefore held by placing 10-in. I-beams beneath them, the direct load of the column above being carried on 24-in. or 30-in. I-beams. To avoid the slow and expensive work of cutting out rivets and bolting brackets to the columns, a slot was chipped out under the cast base at each side, and the I-beams were set with their lower flanges under the base, the slope of the flange being compensated by inserting wedge-shaped steel fillers. The beams were then clamped around the column by six 2-in. diameter bolts, four at the bottom and two at the top. After these were drawn tight the space between the beams around the column base was filled with concrete. With a few of



PLANT LAYOUT ADAPTED TO STREET AND TRACK LEVEL WITH LEAST INTERFERENCE WITH TRAFFIC



SLAB SPANS CUT FOR NEW SUBWAY

the smaller columns, similar to the one shown in the photograph, the concrete filling was omitted and the needles wedged away from the column with wood.

At points between the tracks, I-beam grillages were required. One of the photographs shows a column where the clearance was so small that the bracket plates had to be bent to permit trains to pass.

The columns underpinned outside the slab were carried by beams bearing on cribbing on temporary blocks of concrete constructed for the purpose. Pits were sunk underneath the columns, within which 14-in. pipe piles were driven with drop hammers to an elevation 5 ft. below the bottom of the proposed subway. From three to eight piles were used under each column, according to the load to be carried. As the piles were difficult to drive in the compact sand and gravel after a penetration of 16 ft. had been reached, the pits were generally sunk as deep as circumstances permitted. After driving, the pipe casings were cleaned out with a small orange-peel bucket to within a few inches of the bottom and filled with concrete. Tests of these piles indicated a safe loading value of 35 tons per pile.

Concreting Carried On at Night

The portable concrete mixer used was set up at various points over the platforms below, inside the freight yard of the Long Island Railroad. The team platform outside the freight house covers a vault space inclosed by a vertical partition under the edge of the platform. By breaking through this partition at three points it was possible to hang vertical chutes, through which the mixer could discharge directly into hoppers supplying buggies on the platforms below. To reduce interference with passenger traffic, practically all the concrete work under these platforms was carried on at night.

The other concrete plant, located over the north end of the express tracks, could be run during the day. The mixer did not have to be moved, as an end platform underground across the north side of the station connected the express platforms over the slab. This plant, as shown on the layout drawing, was located near the muck shaft used for this half of the work.

The slab reinforcing is made of square bars top and bottom, varying from 1⅛ to 1⅝ in., and of ⅝-in. square double diagonal shear bars spaced from 12 to 36 in. apart. As it would have been difficult to set the steel accurately according to the first design, this was modified so that each set of shear bars could be tied top and bottom to a pair of the heavy horizontal bars, thus making it possible to assemble all the reinforcing in panel units the length of the section being concreted. The reinforcing was assembled in this way in the pits, tied with 16-gage annealed wire, and stood up with the proper spacing on 2 x 4-in. strips stood on edge across the section being constructed.

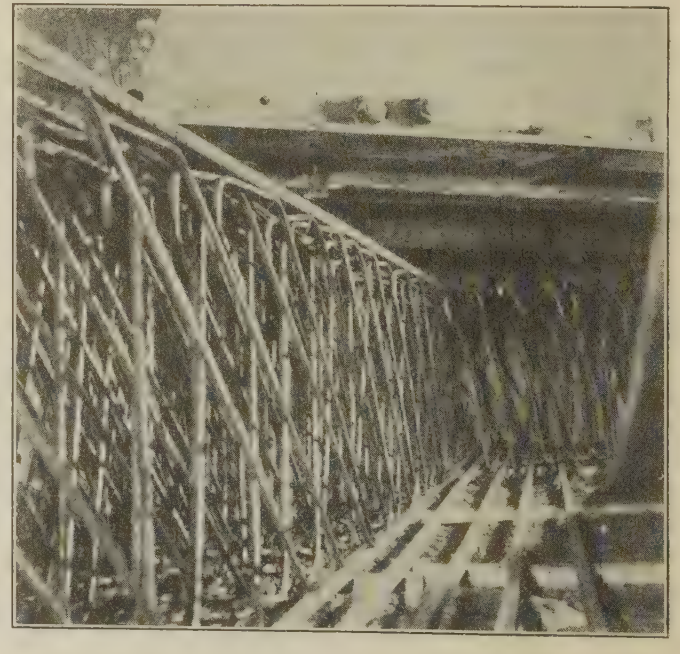
Third Rails Boxed In

Great precautions were taken in building the temporary wood platforms to box in the track space to prevent the workmen from getting their arms or tools in the way of trains. The spaces between and outside the rails were floored, and strips of wide plank were nailed to the posts supporting the platforms. The third rails were entirely boxed in, except for a narrow slot on the inside to accommodate the contact shoes on the trains.

The labor cost for excavation averaged $5.70 per cubic yard, but this includes the removal without blasting of old concrete, the excavation from the underpinning pits, much of which had to be rehandled several times, the work of ballasting and maintaining tracks, and the sheeting of the trench excavation. This sheeting, of course, served as concrete forms. The labor charge for excavation, therefore, is approximately subdivided as follows:

	Quantity, cu. yd.	Unit labor cost	Total labor cost
Platform and slab excavation...	9,520	$3.83	$36,472
Pit excavation	940	6.20	5,828
Concrete removal	1,300	15.00	19,500
Sundry labor, ballasting, etc.....	....	....	6,000
Total	11,760	5.70	67,800

The above unit costs represent only the labor charges on account of the special organization which carried out the work. The excavation cost in the accompanying table, however, also includes, besides its share of the overhead, all labor charged to the work on account of bridging, track, signal, and all other items of work performed by regular forces of the Long Island Rail-



REINFORCING BUILT UP IN PANELS

road. All the unit costs in this table include insurance, supplies, materials, labor, and an allowance for plant, power and water, in addition to office expense, salaries, and other overhead chargeable to the work, both on account of the Long Island Railroad and of the special organization in charge of the work.

COMPLETE UNIT COSTS

Work	Quantity	Unit cost
Excavation	11,760 cu. yd.	$10.60
Slab concrete	4,720 cu. yd.	7.21
Platform replacement concrete	1,130 cu. yd.	20.50
Slab reinforcement	620 tons	68.60
Piling	3,796 lin. ft.	3.28
Temporary support of columns	81 columns	204.80

The work was carried on under an agreement between the Long Island Railroad Company and the Public Service Commission. The design was undertaken by the engineering force of the Public Service Commission, while the actual work was carried out by a special organization formed by the Long Island Railroad Company under the direction of James Forgie as consulting and construction engineer. J. R. Savage, chief engineer of the Long Island Railroad Company, acted as supervising member of the railroad's committee of three in charge of the protection of the terminal. S. V. Morris and C. L. Addison were the other members of the committee. The Public Service Commission was represented on the work by John H. Madden, assistant division engineer.

Flat-Slab-Design Formulas Proposed by Joint Committee

Final Report of Committee on Concrete and Reinforced Concrete Contains Rules Based on Empirical Treatment

AMONG the important features of the new section on the design of flat slabs just published in the final report of the Joint Committee on Concrete and Reinforced Concrete, on page 1691 of the December issue of the *Proceedings* of the American Society of Civil Engineers, are formulas for thickness in terms of loading and panel length, formulas for bending moment, new assumptions regarding the variation in stress across the sections considered, requirements for distribution of steel reinforcement and the increases prescribed for bending moments at wall panels and columns next to the walls. The following abstract of the report covers these essential features of the new section and the principal changes made since the progress report of 1912, so generally used, was published in the *Transactions* of 1914, Volume 77, page 385.

The general recommendations made by the committee relate to flat slabs extending over several rows of panels in each direction, and it is stated that necessarily the treatment is more or less empirical. The coefficients and moments are given for uniformly distributed loads.

The diameter of the column capital is to be measured where its vertical thickness is at least 1½ in., provided the slope below this point is not more than 45 deg. with the vertical. It is recommended that the diameter of the column capital generally be made not less than one-fifth of the panel length. For special loading, variations in panel length, etc., the column capital must be designed and reinforced for compressive stresses and to give rigidity of connection to the floor slab.

The thickness and width of dropped panel may be governed by the required resistance to compressive or shearing stresses. It is recommended, however, that the width should be at least four-tenths of the corresponding panel length between centers of columns, and that the offset in thickness be not over one-half of the thickness of the floor slab.

FORMULAS FOR SLAB THICKNESS

While resistance to bending and shearing forces largely governs the thickness of the floor slab, or resistance to deflection may control in the case of large panels with light loads, it is recommended that no slab less than 6 in. thick should be used, or less than one-thirty-second of the panel length for floor slabs or one-fortieth of the panel length for roof slabs. The following formulas for minimum thickness t, in terms of the panel length L in feet and the sum w of the live load and dead load in pounds per square foot, are proposed.

For slabs without dropped panels

$$t = 0.024L\sqrt{w} + 1\tfrac{1}{2}$$

For slabs with dropped panels

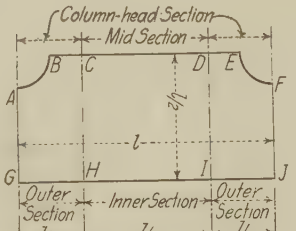
$$t = 0.02L\sqrt{w} + 1$$

For dropped panels whose width is four-tenths of the panel length

$$t = 0.03L\sqrt{w} + 1\tfrac{1}{2}$$

BENDING AND RESISTING MOMENTS

Adopting the analysis by J. R. Nichols in the *Transactions*, Volume 77, page 1670, the report gives the following equation for the numerical sum of the positive moment and the negative moment in vertical sections taken midway between columns and along an edge of the panel parallel to the first section, but skirting the periphery of the column capitals at the corners, as in the diagram:



$$M = \frac{wl}{8}\left(l - \frac{2}{3}c\right)^2$$

in which l is the side of a square panel between centers of columns, c is the diameter of the column capital and w the total load per square foot as before. For an oblong panel there are given corresponding formulas for the sums of moments in the directions parallel to each side.

The proportion of this total resistance M which exists as positive moment or as negative moment is said to be not readily determined, and depends upon the design of the slab; but it is stated that it seems proper to make the division of total resisting moment in the ratio of three-eighths for the positive moment and five-eighths for the negative moment.

As the law of distribution of the resisting moment across the sections considered is not known definitely, it is proposed that certain empirical assumptions be

made. It is considered sufficiently accurate, in general, to divide the sections into two parts and use an average value over each part. Recognizing the effect of tension in the concrete which acts to decrease the intensity of the compressive stress, and using the assumptions given in the report and usual working stress values, the following moment coefficients are recommended, which are somewhat less than those derived by analysis:

For a square interior panel, the total positive moment for a section in the middle of a panel extending across the width may be taken as

$$\frac{wl}{25}\left(l-\frac{2}{3}c\right)^2$$

Of this moment, at least 25 per cent should be provided for in the inner section $l/2$ in width, as shown on the diagram, and in the two outer sections at least 55 per cent for slabs not having dropped panels, except that in determining the necessary slab thickness at least 70 per cent should be used for the two outer sections.

For a square interior panel, the total negative moment for a section connecting column capitals as shown in the diagram and forming the projected width of the panel may be taken as

$$\frac{wl}{15}\left(l-\frac{2}{3}c\right)^2$$

Of this negative moment, at least 20 per cent should be provided for in the mid-section and at least 65 per cent in the two column-head sections, except that for dropped panels 80 per cent should be used for the two column-head sections.

Moments for Oblong and Wall Panels

When the length of a panel does not exceed the breadth by more than 5 per cent, the computation may be made as for a square panel of side equal to the mean of the two dimensions. When the length is between one-twentieth and one-third greater than the breadth, formulas for total positive and negative moments corresponding to those for oblong panels are given, and the apportionment to the various parts of these sections may be made as for the square panel.

For wall panels, the coefficient for total negative moment in the first row of columns away from the wall should be increased 20 per cent over the foregoing values, and likewise the coefficient for total positive moment in the section half way to the wall should be increased 20 per cent. For negative moments at the wall, the relative stiffness of columns and slab and the conditions of restraint should be considered, but in no case should this coefficient be less than one-half that for interior panels.

To make computations for other sections, it is recommended that the point of inflection on any line parallel to a panel edge be taken as one-fifth of the clear distance between the two opposite sections of negative moment, as already considered (see diagram), except that for dropped panels this coefficient should be taken as one-fourth.

It is recommended that all bars be designed to extend twenty diameters beyond the point of inflection or else hooked or anchored at that point; in addition, bars in diagonal bands used for negative resisting moment should extend 0.35 of the panel length across the column center, and those used for positive resisting moment should extend 0.35 of the panel length on each side of a diagonal through the center of the panel. No splices by lapping should be permitted at or near regions of maximum stress, except as just described.

It is recommended that not more than one-third of the bars in any direction be made shorter than the distance between centers of columns in that direction. Bars should not all be bent up at the same point, but the zone of this bending should extend on each side of the assumed point of inflection and should cover a width at least one-fifteenth of the panel length. In the calculations, all bars which cross the section considered and fulfill the foregoing requirements may be used. In the case of four-way reinforcement, the area of diagonal bars should be multiplied by the sine of the angle between the bars and the straight part of the section considered.

At construction joints, it is recommended that extra bars equal in section to 20 per cent of the amount required to resist moment be added, to extend at least 50 diameters beyond the joint on each side.

Stress Analysis

Usual methods for calculating internal stresses are to be used; in the case of the dropped panel, the section of the slab and dropped panel may be considered to act integrally for a width equal to the width of the column-head section. In calculating shearing stresses for diagonal tension at the column-head sections, the total vertical shear on two such sections shall be considered as one-fourth of the total dead and live loads on a panel for a slab of uniform thickness, and three-tenths of this total for a slab with dropped panels. In calculating the punching shear, uniform distribution may be assumed around the periphery of the column capital, provided the total vertical shear be increased by 25 per cent.

Girders or beams should be provided to carry walls or concentrated loads in excess of the capacity of the slab, and also in case openings in the floor reduce the working strength below the required capacity. Special analysis should be made for structures having a width of only one, two or three panels. It is recommended that provision be made in both wall columns and interior columns for the bending moment developed by unequally loaded panels, eccentric loading or uneven spacing of columns. The amounts of these moments should be found by rational methods, using the principle of least work or of slope and deflection. Generally, the larger part of the unequalized negative moment should be considered as resisted by the columns and special attention should be given to wall columns and corner columns.

Other Important Changes

Among the most important of the details in which the final report differs from the preceding progress report are the following:

Blast-furnace slag as aggregate for concrete, especially reinforced concrete, is not recommended, in the absence of satisfactory specifications or methods of inspection to control its uniformity and insure durability. Cinder concrete should not be used for rein-

forced-concrete structures except for floor slabs not exceeding 8-ft. span.

The specifications for steel reinforcement are changed to those for billet steel concrete reinforcement bars of the American Society for Testing Materials.

In specifying the minimum time required for machine mixing, the old value of 1 minute is changed to 1½ minutes, and for mixers over 2 cu. yd. capacity is made 2 minutes. It is stated that a longer time is preferable and that mixers should have a locking device to prevent discharge within the minimum time, and means should be provided to prevent aggregates being added after mixing has commenced. Various desirable additions to mixer equipment and a uniform speed at periphery of drum of 200 ft. per minute are recommended. It is stated that the quantity of water is of the greatest importance—too much is as objectionable as too little.

New paragraphs and recommendations affect reinforced-concrete design. Continuous beams built monolithically into supports may be considered of span length equal to the clear distance between supports, also when the bottom at the ends makes an angle not more than 15 deg. with the axis of the beam. Brackets may be considered to reduce the clear span when they make an angle of 45 deg. or more with the axis. The span can then be taken between sections where the combined depth of beam and bracket is at least one-third more than the depth of beam.

The effective width requirements for T-beams are changed to make the overhanging width on either side of this web not to exceed six times the slab thickness, instead of four times.

Floor Slabs and Continuous Beams

In designing square floor slabs supported along four sides, one-half the live and dead load moment may be used as the moment resisted in each direction. For oblong slabs (length l not over one and a half times the width b) the moment for transverse reinforcement may be taken by using a proportion of the live and dead loads given by the formula

$$r = l/b - 0.5$$

Account may be taken of the fact that the bending moment is greater near the center of the slab by placing sufficient reinforcement in the center half of the slab to carry two-thirds of the total moment and in the two outside quarters to carry one-third.

At the ends of continuous beams, in ordinary cases, a negative moment of $wl^2/16$ may be taken; for small beams and heavy columns this should be increased, but not to exceed $wl^2/12$. New paragraphs suggest that for continuous-beam construction it is important that ample foundations be provided to prevent the unsightly cracks produced by unequal settlement, more likely to occur in low structures. Wall girders should be designed to resist torsional moment arising from negative moment at the ends of the beams framing into them.

Several new and revised requirements in the section on web reinforcement are given, more or less empirical methods being employed.

The recommendations in the section on columns with longitudinal reinforcement contain a new requirement for lateral ties not less than ¼ in. diameter not exceeding 12 in. apart, nor more than 16 diameters of the longitudinal bar. The minimum size of column to which the specified working stresses may be applied is made 12 in. out to out. Hooping or spiral steel must be made at least 1 per cent of the volume of the concrete in allowing 55 per cent higher unit stress for such columns, and the upper limit for ratio of unsupported length to diameter is changed from 8 to 10. The committee has no recommendation to make for columns longer than 10 diameters.

New Paragraph on Concrete Shrinkage

A new paragraph on the tendency of concrete to shrink and the necessity for reinforcement thoroughly to connect together the component parts of floor and wall members, in some proportion to the size of the members, is added.

Finally, a few changes are made in the section on working stresses—the required values for compressive strength are given for proportions 1:3, 1:4½, etc., in terms of combined volume of fine and coarse aggregates measured separately, instead of 1:1:2, 1:1½:3, etc., as in the previous report. Compression for bearing surfaces is increased from 32.5 to 35 per cent of the compressive strength. Axial compression values given are limited to plain concrete piers the length of which does not exceed four diameters. Changes are made in the section on shear and diagonal tension and new explanations added regarding web reinforcement. Bond stress for the best types of deformed bar may be increased, but must not exceed 5 per cent of the compressive strength of the concrete. For modulus of elasticity a new ratio of one-fortieth that of steel when the strength of the concrete is less than 800 lb. per square inch is added.

It is stated that twenty-one members of the committee have taken a more or less active part in the preparation of the final report and all members (twenty-eight) have agreed to it in its present form. Edward Godfrey dissents from the portion relating to stirrups and to rodded columns, and presents an alternate treatment. The committee, composed of representatives from the American Society of Civil Engineers, the American Society for Testing Materials, the American Railway Engineering Association, the Portland Cement Association, and the American Concrete Institute, acknowledges its indebtedness to Prof. A. N. Talbot, Prof. W. K. Hatt and Prof. F. E. Turneaure, the subcommittee on design, for their invaluable and devoted service. J. R. Worcester is chairman and R. L. Humphrey is secretary of the Joint Committee.

Error in Equation for Velocity of Pressure Wave Through Pipe Lines

In the article by Barton M. Jones on pipe design based upon water-hammer pressure an error in the original copy was made in the equation for velocity of pressure wave through the pipe. This equation for velocity v, given at the bottom of the first column on page 795 of the issue of Dec. 30, 1916, should be changed to read

$$v = \frac{47{,}200}{\sqrt{\frac{d}{t} + 102}}$$

Results Given for Field Tests of Reinforced-Concrete Pipe

Diameters for Storm-Water Sewer at Winnetka, Illinois, Varied from 24 to 36 Inches—Applied Load Proportioned to Pipe Diameter

By J. T. CHILD
Winnetka, Ill.

FIELD tests of circular reinforced-concrete pipe from 24 to 36 in. in diameter, laid last fall as a storm-water sewer in Winnetka, Ill., gave results shown in the accompanying table. In making the tests it was specified that both the load and the pipe itself should

SACKS OF SAND OR CEMENT FURNISHED LOAD FOR FIELD TESTS

have a bearing over one-sixth of the circumference of the pipe. The test pipe was required to sustain without failure a load in pounds per linear foot equal to the inside diameter of the pipe in feet times the factor 1000.

The tests were made by piling full sacks of cement or sand on a wooden platform made to fit the curve of the pipe. A depression in the ground made the required bearing surface for the pipe. These conditions approached as nearly as possible the actual conditions the pipes are subjected to and made testing easy. All the concrete pipes on the job were circular, with the wire-mesh reinforcement placed concentrically. They were made by the Reinforced Concrete Pipe Company, of Chicago.

The cracks which developed were hair cracks in all cases and did not extend the entire length of the pipe. They were in no sense pipe failures. The cracks disappeared when the loads were removed from the pipes. After Nov. 1, the water and sand used for making the concrete was heated, and salamanders were used inside the pipe until setting had taken place. Fourteen days were specified as the time for curing the concrete. The inadvisability of laying green pipe is shown in the tests on 33-in. pipe only 11 days old.

An additional storm water sewer is planned for Winnetka for next year which will amount to over $60,000. The pipe from 24 in. up to 51 in. will be of reinforced concrete.

FIELD TESTS ON REINFORCED-CONCRETE PIPES

Size, Inches	Age, days	Required load $4xD' \times 1000$ lb.	Load applied, pounds	Remarks
36	20	12,000	12,000	No cracks.
33	11	11,000	11,000	One crack in bottom. Pipe too green.
33	11	11,000	12,625	Two cracks at top 1 ft. apart; one at bottom; pipe too green for laying.
33	26	11,000	11,000	Crack in sandy seam.
33	20	11,000	11,000	No cracks.
33	9	11,000	11,000	No cracks; warm water used in mixing in November.
30	20	10,000	10,450	No cracks.
24	20	8,000	8,000	No cracks.
24	30	8,000	8,000	No cracks; cold weather Nov. 10 to Dec. 11.

Orders New Basis of Rates for Fire Protection

Illinois Utility Commission Stipulates Rental per Foot of Main Extension in Addition to Flat Rate per Hydrant

FIRE PROTECTION for municipalities, where the waterworks are under private ownership, is commonly charged for at a uniform rate per hydrant. A departure from this plan is ordered by the State Public Utilities Commission of Illinois in a decision recently made in the rate case of the city of Lincoln versus the Lincoln Water & Light Company, Commissioner Walter A. Shaw writing the opinion. The plan stipulated by the commission was proposed by Dabney H. Maury, consulting engineer, of Chicago, one of several engineers called into the case at different times to appraise the property. The rates prescribed in the opinion are $8,900 per annum for the service as of the date of valuation (Nov. 1, 1914), $5 per year rental for each new hydrant, and the following rates per year per foot of main extensions of various sizes: 4-in., 5 cents; 6-in., 6 cents; 8-in., 8 cents; 10-in., 11 cents, and 12-in., 14 cents. The new schedule recognizes that the cost of hydrants is only a small part of the total cost of service, and that to impose the whole burden on the hydrants is to tempt the municipality to get along with inadequate fire protection.

Wear of Wood-Block Paving in Minneapolis

An official inspection of wood-block pavement laid in Minneapolis during 1906 shows that in only two out of thirteen sections were more than 5 per cent of the block depressed as much as ½ in. below the general level of the street. The two exceptions were in the heaviest traffic districts of the city, and one of them showed 13.5 per cent of the block depressed as compared with 16.5 per cent in the other section. Those sections of pavement made with longleaf pine and birch showed only 2 per cent of the blocks depressed after 10 years' service.

American Society's Valuation Committee Presents 230-Page Report

Depreciation Section Revised to Differentiate Between Classes of Utility —All Real Land Costs Should Be Allowed, But No "Higher-Use" Value

COMPLETE revision of the section on depreciation, objected to so strenuously by the membership of the American Society of Civil Engineers when its special valuation committee rendered its first report three years ago, is one of the features of the new report just presented by the committee. As to whether or not depreciation should be deducted in rate cases, distinction is now made according to methods of depreciation accounting and the character of regulation that have prevailed. Only where provision is made in the rate, or should be in the accounting, for an accumulating fund is a deduction advocated for loss of service life, and this the committee would offset by the fund so long as it has not been returned to the owners of the utility. The theory makes railroads exempt from deductions. The equal-annual-payment method for computing depreciation is still favored, but is now called the compound-interest method. That estimated original cost is not dependable; that original topographic conditions but present-day prices and methods should govern in estimating reproduction cost; that all real items of cost but no "higher-use" value should enter into the reproduction cost of land, and that development expense and going value are distinct—the one tangible, the other intangible—are among the numerous other noteworthy findings of the committee.

The report of the committee is published in the December *Proceedings* of the society, beginning on page 1709. It contains 230 pages. Of these, 211 pages constitute the report proper, which is preceded by an abstract that in itself contains 12 pages. The committee states that in the five years since its appointment forty-eight joint meetings have been held and a correspondence aggregating thirteen substantial volumes has been carried on. The report is signed by the present members, Frederick P. Stearns, chairman; Leonard Metcalf, secretary, and William G. Raymond, Jonathan P. Snow, Charles S. Churchill, Henry E. Riggs and William J. Wilgus. The latter three were appointed in 1914 to fill the vacancies caused by the deaths of Thomas H. Johnson and Alfred Noble and the resignation of Henry M. Byllesby.

The committee's abstract, slightly condensed, follows:

GUIDING BELIEFS OF COMMITTEE

The committee, in its consideration of the subject assigned to it, has been guided by the belief that stress should be laid on fundamental principles and general methods rather than on details which necessarily vary under different circumstances; that the discussions, unless otherwise stated, should be confined to normal properties; that valuation should have its foundation in fact; that where there are alternative methods equally fair to the parties affected, the one should be selected which is most capable of being carried out effectively under present laws, as defined by the courts, and which is most desirable for general use in the direction of uniformity; that recognition should be given to the interdependence of the various elements which enter into the problem; that while major attention should be given to the ascertainment of the cost of creating the property in question and its business, due consideration should be given to intangible values, and that the important item of interest, in this report meaning interest compounded annually, should always be considered.

In the light of this preliminary understanding and of the discussions which ensued, the following conclusions have been reached:

Fundamental Principles of Valuation

The principles and methods must be such that when properly applied the result will be fair to all parties affected and of a nature that will attract to the service of the public capital necessary for building new properties and for improving and extending old ones.

New Properties—In the valuation of a new property, if the question of a fair return is at stake, the actual investment in the portion devoted to public use, including working capital and development expense, should be taken as the basis for "fair value"; if the same property is to be valued for public acquisition, the basis of "fair value" should be the actual cost, including the money value of services and other considerations involved; if the valuation is to be used for capitalization, the result should be attained in the same way as the return base, except that all parts of the property should be included; and if for taxation, whether of a new or old property, the result must accord with the laws of the state, or, where not governed by such laws, should be fixed at a sum consistent with the valuation of other property for taxation.

Old Properties Under Continuous Regulation—In the valuation of an old property, operating without competition and from its inception under commission control as to rates and methods of accounting, and assumed to have been entitled to earn sums sufficiently large to provide for all expenses of maintenance, operation and taxation, depreciation allowances and a fair return on the "fair value" of the property, the owner should be compensated in some way for losses sustained during the early years of operation before the property was tuned up and the business developed, either by including in the valuation the sum of the deficiency of earnings in the early years, with interest, or by allowing higher rates of return in subsequent years to offset the early deficiency.

Old Properties Not Under Continuous Regulation—In the valuation of an old property which has not been subject to continuous regulation, not only are the foregoing principles important, but there are many cases in which equity calls for the inclusion of not only the sum representing the sacrifice by the owner but also a further positive or negative sum representing valuable property or rights acquired or lost by the owner as a

result of time or through the failure of the public or the owner to assert his authority, the courts holding that the present value of the property should be used rather than its cost.

Physical Property to Be Included

The physical property to be included varies in different cases with the use to which the valuation is to be put and the law governing the case.

Used and Unused Property—In cases of rate regulation, only the property considered devoted to public use should be included, embracing that in active use and also that properly and reasonably held in reserve to insure the safety, economy, sufficiency and continuity of service. In valuations for capitalization and public acquisition all of the property in question should be included.

Retired or Discarded Property—Plant units definitely abandoned and not likely again to be used, due to having been worn out in service or by reason of the reconstruction of the property, should be excluded from the valuation and should appear either in a separate schedule of retired or discarded property, or such full statement of the conditions should be made as will definitely fix the status of the units or parts. Temporary works necessarily built in connection with, or required for, the construction of permanent works, or for furnishing service to the public at an earlier date than it could be furnished by the permanent works, should be included in the valuation.

Excessive Size or Capacity—No reduction should be made in the valuation on account of excessive size or capacity, except when the excess is so great as to be clearly unreasonable and is the result of not using proper foresight.

Donated Property—Lands or other property voluntarily donated to a public utility should be included when determining the reproduction cost, on the same basis as land and property otherwise acquired.

Leased Property—In the case of leased property, either the property itself or the lease should be valued, as circumstances may dictate.

Title to Property Not Conclusive—Structures located on land to which the owner of a public utility has no title should be *included* in the valuation of the property where the owner has been required by law or necessity to pay their cost, including in this class also property voluntarily donated; and they should be *excluded* where other public-service companies, the public or the users, other than the owner in question, have been required to pay their cost.

Working Capital—It is customary to include under the term "working capital" the amount of cash, materials and supplies provided for use in the plant, but not yet forming a part of it, and other current assets essential for proper maintenance, operation and administration. There should be included an amount of working capital sufficiently large not only to meet the usual requirements, but to provide for emergencies.

Securities Owned—Ordinarily, the valuation of property devoted to public use should not include securities owned, or surplus cash not forming a part of working capital, except in instances where such securities and surplus cash are an offset, in whole or in part, for depreciation deducted from the cost of the property.

Original Cost to Date

As defined by the committee, original cost to date is the first cost of the identical property units now in use, including overhead charges.

Difficulties—While much of the difficulty of determining original cost as thus defined in some cases may be removed, especially in the case of short-lived property, it is not feasible to obtain a dependable result where the absence of reliable historic data makes necessary a resort to estimates, as in the case of old properties consisting mainly of long-lived items.

Schedule—Generally it will be found necessary to prepare a schedule in the same way that one would be made for determining the cost of reproduction, many adjustments in the records often being required, even under the most favorable conditions, in order to obtain correct results.

Costs—Unit Costs—When a schedule is necessary, the corresponding costs or unit costs are essential to the completion of the inventory, and where these are unobtainable, as is usually true in the case of property units acquired or created long ago, the ascertainment of the original cost is impossible.

Overhead Charges—Overhead charges are, as a rule, inadequately reflected in the records, and therefore adjustments are required which are largely matters of opinion and speculation, and which, in consequence, make more uncertain the final result, thus often destroying its usefulness.

Development Expense—The expense actually incurred in connection with the tuning up and creation of the business of a property should be included as a part of the original cost to date.

Cost of Reproduction

Theory of Reproduction—Estimates of the cost of reproduction should be based on the assumption that the identical property is to be reproduced, rather than a substitute property; that while apparent present-day conditions that would affect the cost of reproducing the property must be considered in any logical estimate, yet history must also be considered to determine what is to be reproduced, the conditions under which it is to be reproduced, and how the estimates must be made; that for all those items concerning which there can be no doubt the engineer should use the basis plainly applying, and that for those that are doubtful, or have been questioned, he should present the effect of the use of the different bases clearly, that the determining body may have the data for a wise decision; and that normal present conditions shall determine the prices and methods for doing the work.

Preliminary Work—The first step in estimating reproduction cost is such a study of the property and its history as will enable the estimator to make a complete list of all items, lay out a proper financial and construction program, and fix proper unit prices to the several items of the schedule, after which the property should be divided into groups of items or units which will lend themselves to the depreciation study and accounting, preferably following some well established classification of accounts.

The field schedules and inventories, suitably recorded on appropriate forms, should not only be based on full

and complete surveys and inspections of the visible physical property, but should also reflect a careful historical search of existing records of original conditions and other reliable sources of information bearing on items of material or work which entered into or were incidental to actual existing units, special care being exercised to exclude that not capable of definite proof, and to limit the speculative uncertainties as far as possible.

Unit Prices—In determining unit prices a rational sequence of construction should be assumed, and rational assumptions made as to the manner of doing the different parts of the work, whether by company forces or by contract. Unit prices based where possible on the actual cost of doing similar work, in a similar manner, under similar circumstances, should be determined by persons of experience and sound judgment. They should be based on the normal average cost of work for a considerable period—say, 5 or 10 years. In the case of items which are steadily increasing or decreasing in value, the prices adopted should be normal for the time of the valuation. Full consideration should be given to the time allowed for construction, to climatic conditions and to the effect of any other significant conditions or limitations upon the cost of the work.

Reproduction Cost of Land

Separate parcels of land, such as one or two lots, or a tract of not unusual size, not connected with other lands of the utility in a strip or body, and where freedom of choice in selection may be exercised, should be valued on the same basis as other lands in the vicinity used for general purposes.

Where large tracts have been acquired, made up of a number of separate entire parcels, the history of the transaction should be completely investigated and allowance made in the estimate for costs of vacation of streets, or acquisition of other rights, incident to the use of the property as a whole. Such further allowances should be made as may seem to be justified by experience to cover excess costs over the normal market values existing at the beginning of the project, due to fluctuations of price or other causes beyond control. Normal market values of similar and near-by property, as of the time of appraisal, should be the basis, with such additions as are warranted by the investigation in each case.

Continuous Rights-of-Way

In the consideration of values of lands for rights-of-way for a railroad, an electric railroad, an aqueduct or other like property, or lands for a water-works or hydroelectric reservoir, where freedom of choice is restricted and all the land must be acquired, radically different methods must prevail.

In the valuation of lands of this class, a clear distinction should be made between: (*a*) Lands where the entire tract or parcel is taken and there is no element of severance damages, and (*b*) lands where only a portion is taken and the element of severance damages is present. The extent of lands of both classes should be shown.

Historic conditions, where ascertainable, should be given due weight in fixing the extent and character of the severance. All elements of value to the seller, including recognition of all damages to the portions of his property not taken, which would prevail in the case of condemnation, should be considered.

A determination of the relation existing between actual recent acquisition costs and the normal market value of the lands out of which the strip or parcel was taken at the time of acquisition is undoubtedly possible in many cases. It would seem that where such relation can be determined its use in connection with the normal market values of these or similar lands at the time of appraisal should establish a reasonable cost of reproduction.

All Real Items of Cost to Be Included

The determination of the figure to be used should be based in all cases on full consideration of the present normal market value of the area of land acquired and of other recent purchases by the same or other companies of similar lands in the vicinity or in districts of like characteristics; the damage to the remaining land, not required, due to severance and all consequential injuries; the amount and character of the costs of acquisition and overhead charges; enhanced prices due to active demand, and any other real items of cost which would be included in case of purchase. But no allowance should be included for special values coming after the acquisition of the property on account of its new use or on account of a greater earning power under the new use, or for any other hypothetical "value."

Estimates should be based on prices and values as of the time of appraisal, be they higher or lower than those prevailing at the time of original acquisition.

The treatment of the valuation of land holdings is not yet thoroughly crystallized; therefore the valuing engineer will do well to confer with counsel upon the interpretation of past court decisions and the legal principles which are most fairly applicable to the case under review.

Overhead Charges

There are certain expenses called overhead charges, inseparable from the construction of any property, which are a necessary and proper part of its cost but are not capable of physical identification after the completion of construction work. These expenses cannot be covered in the estimate of cost of reproduction by the application of specific unit prices; from their nature they attach to the whole or large parts of the property rather than to any particular units.

Among the expenditures which must be provided for and classed as overhead charges are:

(*a*) Cost of promotion.

(*b*) Cost of financing and securing the necessary capital with which to carry out the enterprise.

(*c*) Cost of organization, including the incorporation and organization of the company, securing of franchises, and other like expenditures.

(*d*) Engineering, including the making of the preliminary investigations and plans, plans for the construction of the entire property, the engineering supervision of all construction and other work involved in the development of a property, except such direct supervision as may properly be included in the unit prices of various property units, or as specific charge against some particular schedule or group of units.

(*e*) Administration, including salaries for general officers, agents, accountants, clerks and other assistants not included in the engineering and legal departments, and all administration expenses.

(*f*) Legal expenses, including salaries and expenses of law officials and costs of litigation which, depending on the character of the property and its location, may be a comparatively minor item or a very large one.

(*g*) Interest during the period of construction on money borrowed or on money invested in the property by its owners.

(*h*) Taxes and insurance during construction.

(*i*) Contingencies, representing expenditures which cannot be foreseen but which from one cause or another are always of considerable size in the construction or reproduction cost estimate of any great enterprise.

Depreciation and Appreciation

With a desire to remove the ambiguity and resulting confusion that has attended the use of the term "depreciation" in connection with valuation, the committee has considered the subject from three standpoints: (1) The cause, *decretion* or loss of service life; (2) the record, *accounting depreciation,* or the money allowance made in bookkeeping to offset accruing loss of service life; and (3) the amount sought, *depreciation of valuation* or *fair depreciation,* the sum which should be deducted from original cost to date or from estimated cost of reproduction new as a step in finding that which the courts have called "fair value."

Decretion or Loss of Service Life

Decretion is the fact of loss of service life of a physical property, property unit or item, regardless of its effect on value or anything else. It may be due to use, inadequacy, obsolescence or accident, either singly or in combination.

Although, in a well-maintained property, decretion is always present in some degree, yet in some cases this decretion, converted into loss of value, which loss is hereafter called cost of decretion, should not be considered to be a deductible quantity in finding the value of the property—that is, it should not be considered as depreciation of valuation or fair depreciation. Unfortunately, this has not been entirely understood.

Whether or not, and to what extent, if any, the loss of value due to existing decretion shall be deducted from original cost to date or cost of reproduction new, when finding "fair value" for any purpose, is the great troublesome problem of depreciation in valuation.

Accounting Depreciation

The fundamentals of the methods of accounting for depreciation are that the owner of a public utility is under obligation to the investors in its securities to maintain the integrity of the investment as a continuing property and to furnish suitable service to the public; that the public is under obligation to the owner to pay a fair price for the service rendered, which should cover all operating expenses, a proper allowance for depreciation and a fair return upon the "fair value" of the property; and that the return to the investor and the rates to the consumer should be kept reasonably stable and uniform from year to year, and should be fair.

The four accounting methods in use for accounting for depreciation, the replacement method, the straight-line method, the compound-interest method (formerly called by the committee the "equal-annual-payment method"), and the sinking-fund method, yield identical total costs when the whole life of a property unit is considered, and any one of them seeming to be the most convenient may be chosen, provided only that under the circumstances it is legal, safe and fair.

The replacement method is applicable to short-lived properties or parts of properties made up of a large number of items, the replacement or retirement of which proceeds after a time with fair regularity and causes no troublesome variations in return or service rates; the straight-line method applies to any property units having more than a year of service life, which are assumed to depreciate uniformly from the beginning to the end of service life; the compound-interest and sinking-fund methods apply to property units the depreciation of which is assumed to progress at the same rate as a sinking fund grows from an annuity, accumulating at compound interest.

In addition to these four methods there is the unit-cost method, eminently sound in theory but not readily applicable to accounting purposes, based on the conception that the value of a plant unit should be decreased from year to year to such an extent that the cost per unit of output or service, taking into account all annual charges for interest, depreciation repairs, cost of operating, etc., should be constant during each year of the estimated service life of the unit.

The great discrepancy in the growth of depreciation of long-lived units under the straight-line and compound-interest theories should be carefully noted when determining which method to use.

It would seem fair in any given case to give the method of accounting used by the utility in setting up depreciation allowances its proper effect in determining deductible depreciation or the depreciation of valuation.

Depreciation of Valuation

Dependence on Accounting Methods and Regulations—Finding the cost of decretion here defined as the loss of service life of an item converted into loss of value, is a step in the determination of depreciation, but whether and to what extent, if at all, the estimate thus found shall be treated as depreciation of valuation may be, and very probably will be, dependent, at least in part, on the methods of accounting for depreciation and the character of regulation that have prevailed.

Replacement Method—If by order or sanction of a regulating body, or by long-continued proper custom under no regulation, a property, as for instance a railroad, has been maintained in normal working condition, necessarily less than new in some or all of its parts, by the replacement method, and at any given date is being valued for any public purpose and at that date shows normal condition, all its several parts being in as good condition as could be expected, the accounts showing that those amounts have been expended in renewals that were necessary to keep the property in normal working condition, and the fact appearing that no expenditure reasonably to be expected could put the property in better than the normal condition in which it is found, and that no unusually large expenditure is

presently to be necessary for this purpose, then, in spite of the fact that there is an existing decretion in its several parts, there should be found no depreciation of valuation. Under the method of accounting the public has not paid, and could not pay, for the accrued depreciation, and under this condition its accrued obligation to pay should be considered an asset of the company owner.

If parts of the property are maintained under the replacement method and part by some proper allowance method, except as noted below, then depreciation of valuation should be found with respect to those parts maintained under the allowance method, but this depreciation of specific physical units will be made good in whole or in part by existing funds or property purchased with allowances, either or both of which will be included in the valuation as they are found.

When to Deduct Depreciation

If in the judgment of the valuing engineer the replacement method may not be used with propriety for a given property, either because not in accordance with law, or because the method is not adapted to the property, then, whether or not the property has been maintained in the past under this method, the valuing engineer should estimate depreciation of valuation in the amount of the cost of the decretion he finds. There can be no certainty that the property will be properly maintained in the future.

When a comparatively new property, other than a railroad, is to be valued, and it has not been under any regulation that has affected its accounting methods, the law as laid down in the Knoxville decision would seem to make it necessary to find depreciation of valuation in amount equal to the cost of decretion found for all items, whether or not maintained by the replacement method. The committee, however, believes that this may work hardship and injustice in some instances, and suggests that in such cases the facts be reported with such recommendations as to equity as may seem fair to the engineer.

Allowance Methods and Effect of Regulation

Allowance Methods—If either the straight-line, compound-interest or sinking-fund method has been used in computing depreciation, and the method of accounting for it has been prescribed by a regulating body or voluntarily followed by a company owner from the beginning, the same theory, so far as it applies to the property in question, should be used for estimating the cost of decretion; and the entire cost so found, lessened by any accumulated depreciation funds, will appear as depreciation of valuation, unless the sinking-fund method of accounting has been used. In the latter case, if the valuation has to do with the reasonableness of the return and the accounting is to go on as before, apparently existing depreciation would not be depreciation of valuation, and therefore would not be deductible; but if the valuation has to do with condemnation or purchase, then, as in other cases, the apparently existing depreciation is depreciation of valuation, and the owner should receive the depreciated value of the physical property and the existing fund.

Effect of Regulation—Regulation which determines the method of accounting will in part determine the amount of depreciation of valuation when finding "fair value," because it determines the method by which the public shall pay for the loss of service life. If the regulating body has prescribed the replacement method for the whole period that units have been in existence, then, although depreciation may exist, it is not depreciation of valuation, because, under the method of accounting, the public has not paid, and could not pay, for the accruing depreciation, and is still under obligation to pay for it.

Where Depreciation Allowances Were Not Formerly Granted

Methods of accounting in force at the present time which make proper provision for the accruing depreciation should not have full weight if, in previous years during the life of the property units, other methods were in use which did not make provision for such depreciation. The amount of depreciation of valuation in such cases should be equivalent to the accumulated contributions of the public for depreciation allowances under the various methods of accounting which have affected the property unit from time to time. The public is still under obligation to make good that part of the loss of service life not yet paid for, and this obligation should be considered as much the property of the company usable to offset accrued depreciation as renewal funds or property actually in existence.

Whether or not this reasoning will stand in any case is for the court to determine. Valuing engineers and accountants should report what they find as to the actual cost of decretion, and the sums which have been received to offset such cost, under the methods prescribed by the regulating body from time to time. They may give their opinions as to the amount of depreciation that should be deducted from cost to find cost less depreciation as an element in the quantity known as "fair value."

Where Past Earnings Were Limited

If regulation has not fixed accounting methods, but has limited the earnings, it should be permissible to inquire whether the limited earnings have been sufficient to pay operating expense, depreciation, and fair return. If so, depreciation found should be considered depreciation of valuation to the extent warranted by the accounting methods lawfully or properly followed; if not, a question arises. It is remembered that the duty of the company owner is first to maintain the property "before coming to the question of profit at all," and that it is the duty of the regulating body to see that rates are such as to permit the company owner to earn operating expense, depreciation and fair return. If the regulating body has made sufficient earnings impossible, is it still the duty of the company owner to maintain the property before paying fair return to its security holders? If it is, depreciation of valuation should be found in the amount of the total cost of decretion or so far as warranted by the accounting methods followed. If not, depreciation found should not be considered depreciation of valuation except to the extent covered by earnings after deducting operating expense and fair return. This is a matter of equity to be determined by a court. If under regulation the property is a losing venture, it is not included in the class of properties now being considered. In any event the depreciation

existing should be found and reported, together with all pertinent facts, that the court may determine the equities of the case.

Conclusion Upon Depreciation

The valuing engineer should bear in mind that when a company owner has invested a reasonable sum in a property for public service, it is entitled to, but not guaranteed, a fair return on its investment, so long as the money remains in the property, either as property, funds, or accrued public obligation to pay. Therefore, so long as the company owner keeps a sum equivalent to the total investment at work for the public, either as property serving the public, or funds held in reserve for such property, no policy should be followed in estimating depreciation that will reduce the property to a value less than the investment, or, when using cost of reproduction less depreciation, as a basis of "fair value," to a value less than the cost of reproduction of that part of the property estimated to have been created with company funds, acquired by gift, or in any way not the result of public contributions to cover depreciation.

Appreciation

Appreciation, largely the result of solidification, seasoning and adaptation, represents the improvement in quality and usefulness of certain parts of the physical properties of a railroad or other public-utility property. It results from the lapse of time, from work not specifically charged to capital account, from maintenance, from use, etc., and covers items, not represented either by the quantities or unit prices, that are determined in connection with a valuation.

There should be no general setting off of appreciation against depreciation, but appreciation should be determined independently from depreciation. Care must be taken that items of labor and expense included in the estimate may not be duplicated in development expense.

Development Expense

In the production of a normal going property, development expense, almost invariably, is an unavoidable real cost, and is measured by the difference between the amount which the company is entitled to earn in the early years and the amount which it actually does earn. The portion of this expense incurred in tuning up the property and bringing it to its present state of operating efficiency may be included in the cost of construction, and the remainder may be treated as the cost of acquiring the business.

Intangible Value

The intangible value that pertains to a property and should be given due weight in the ascertainment of "fair value" is the difference between the tangible value —that is to say, proper cost including development expense, less depreciation of valuation—and exchange value, in which is reflected existing and potential dependable income and beneficial results. It embraces going value, in which is merged good will, franchise value, efficiency, favorable business arrangements and design; and it also includes other elements, such as leases, easements, water rights, traffic and operating agreements, strategic location and advantages, and other privileges.

Oiled Road Through Mojave Desert Built for $950 Per Mile

Eight-Foot Strip Treated with 2½ Gallons Per Square Yard, Worked with Harrows and Rolled with Horse-Drawn Roller

By J. S. BRIGHT
Chief Engineer, San Bernardino County Highway Commission, California

TO build 80 miles of oiled road through the Mojave Desert in California at a cost not exceeding $1,000 per mile was the task which the San Bernardino County Highway Commission undertook recently and is now completing. The desert section of the route is only part of a program of new construction financed by a bond issue of $1,813,000. Of this amount $125,000 is being spent on the desert highway and the remaining $1,688,000 on 187 miles of concrete and macadam roads in the fertile districts of the county.

The desert road which is being improved is the

APPEARANCE OF COMPLETED DESERT ROAD

Santa Fe Old Trails transcontinental highway, 290 miles of which is within the boundaries of this county. Fifty miles of this road within the fertile districts has been paved with concrete and macadam, leaving 240 miles to be made passable with the fund of $125,000. Of the 240 miles of desert road, 160 miles is a good earth road, needing no particular work except grading to make it passable. It was estimated that $1,000 per mile would be all that was available to spend on the remaining 80 miles.

Desert Soil Varies

The desert is not, as commonly believed, an endless waste of drift sand, but the soil varies according to the location and slope of the country. The steeper slopes are of hard gravelly clay or a lime formation called caliche, both of which make good natural road surfaces. From the steeper slopes to the bottom of the valleys the soil grades from good gravel to fine sand. One exception to this rule is a stretch from Lavic to Bagdad, where areas of volcanic ashes are encountered. These beds of ashes are generally hard when the loose top surfaces are removed, but soon powder into dust and wear into chuck holes under traffic.

In locating the road it was found that it was sometimes impossible to avoid poor road soil and that a surfacing had to be provided where the line crossed the bottom of the valleys and the beds of volcanic ashes. Drainage had also to be studied as carefully as if in a

THE ROAD WAS FINISHED WITH A 6-TON ROLLER DRAWN BY HORSES

humid climate. Though the annual rainfall is only about 2 in. it generally falls in 2 hours and results in heavy floods. It is not practicable to provide storm ditches and bridges. To overcome this difficulty the road grades were made to conform with the profile of the ground, with the center as near as possible at right angles to the drainage. No fills were made at the washes, but the banks were always cut back to dip the road to the grade of the creek bed. Wherever possible the highway has followed the lower side of the Santa Fe Railroad both to get protection from storm water and to obtain a short haul for material shipped by train.

Weather conditions reach extremes on this desert, the temperature being subject to great variations, ranging from 115 deg. Fahr. in summer to freezing in winter. Windstorms are prevalent in spring and in au tumn. The atmosphere is always very dry and has a disastrous effect on all wooden road machinery.

The traffic consists principally of automobiles carrying transcontinental touring parties. Horse-drawn vehicles are rare. The most serious menace to the road surface is an occasional fleet of trucks going to a mining boom, heavily laden with fuel and oil. Wherever these trucks strike a sand stretch they invariably stall, dig up long stretches of the wheel tracks and pound the surface into ruts.

Caliche Surface Tried First

The San Bernardino County Highway Commission first tried covering the road with caliche or hand-screened gravel, but soon found these surfaces had to be finished with asphaltic oil to prevent rubber tires from sucking the finer particles loose from the body of the covering. This type of construction could not be completed for less than $2,000 per mile.

The second plan tried was an oiled petrolithic surface, which produced a good road, but for an 8-ft. driveway it cost about $1,500 per mile.

The plan finally adopted was to oil an 8-ft. strip, working the oil with harrows, omitting the petrolithic tamper and depending on the traffic to do the latter's work. The saving made with this system was mainly in the amount of oil used. In the petrolithic plan it took at least 4 gal. per square yard of oil to produce a surface, but with the last method it averaged only about 2½ gal. per square yard. The cost for an 8-ft. roadway was about $950 per mile.

CATERPILLAR TRACTORS WERE USED TO HAUL OIL

During the hot weather 80 per cent asphaltic road oil was used, but during the cool weather and on the stretches of volcanic ashes 75 per cent asphaltic oil gave better satisfaction. This oil must be heated before unloading and spreading. To accomplish this a 30-hp. portable boiler and feed pump are used. The oil is generally handled at a temperature of 175 deg. Fahr.

The roadway is prepared by grading a width of 20 ft. with a blade machine, starting on the high side and working the material to the lower side, keeping the roadway cross-section as nearly level as possible. This has the result of lowering the roadway to allow the storm runoff to pass over without washing and also leaves a coarse material, as the top 6 in. is generally drift sand. Two four-horse fresno teams follow the graders to remove the bumps. Two men throw out all surface rocks of any size. This work costs from $50 to $210 per mile.

To make the material uniform after the grading is completed, and to assist the oil to penetrate, the surface is worked for a depth of 3 or 4 in. with a goose-neck harrow for a width of 8 ft.

Construction of 8-Foot Oiled Desert Road

	Cost per mile
Hauling oil with teams	$100
Heating oil	45
Oil	375
Cultivating and dragging	80
Maintenance of equipment	25
Superintendence and overhead	50

Oil Applied in Three Coats

The oil is applied in three coats. The first two coats are of 1 gal. per square yard each, and the last coat of ½ gal., unless the material is especially fine, when it is necessary to apply as much as a full gallon. Each coat is thoroughly incorporated into the road surface by working it with a spike-toothed harrow, followed by a road drag. After the third coat is applied and dragged the traffic is allowed to come on for two days; then the road is again dragged, and with the traffic this operation is again repeated until all soft spots disappear. The road is finished by rolling with a 6-ton horse roller. Power rollers are impracticable while the road surface is still new.

To maintain this road surface it will be necessary to keep a patrol truck loaded with oiled gravel constantly at work tamping up the weak spots. Every four or five years the surface should be rooted up with a power roller and rerolled, followed by a seal coat of oil, which should gradually produce a good road and a fairly economical one for the class of traffic expected.

This work, like all the improvements handled by the San Bernardino County Highway Commission, has not been done under the contract system, but has been handled by the chief engineer through a superintendent under his direction, who hires all the labor and teams by the day.

Caterpillar tractors were tried for hauling, and were economical during very hot weather on long hauls, but

during cool weather and on short hauls teams are better, mainly because of the destructive effect of the tractor on the wagon trains. The side thrust on the lead wagon of a three-vehicle train making a short turn is excessive and is especially destructive to wooden wheel hubs if the temporary road is loose sand mixed with occasional rocks.

Trucks for hauling oil are out of the question unless there is good oiled material to travel over. Undoubtedly trucks can be used in maintenance work in applying the seal coats. The chief items of construction cost are given in the table on page 65.

San Bernardino County was fortunate in having three very energetic commissioners, who spent considerable time from their ordinary business to look after the many details resulting from day-labor work. B. R. Kennerley was superintendent in charge of the largest portion of this desert work.

New Steel Column Tests Reported by Special Committee

Results Given for Extension of Original Program of Investigation at U. S. Bureau of Standards Completed During Past Year

RESULTS which, in general, confirm the tendencies reported last year by the special committee on steel columns and struts of the American Society of Civil Engineers in its progress report (abstracted in the Engineering Record of Jan. 15, 1916, page 81) have been obtained in the supplementary tests completed during the last year. As recorded in the progress report of this committee printed in the *Proceedings* for December, page 1643, the tests on columns of extra-heavy metal show decreased ultimate strength for H-columns but little decrease for the built-up I-sections. Tests on new short columns with a slenderness ratio of 20 confirm results obtained for retested columns of similar form. Relatively less reduction of strength for heavy sections is found for the long columns with a slenderness ratio of 155. The abstract which follows includes the most significant parts of the report and the results of the new tests.

THREE LINES OF INVESTIGATION COMPLETED

Three lines of investigation, mentioned in the last progress report, have now been completed. They are: (1) New short columns of a slenderness ratio of 20 supplement the tests of similar columns cut from longer columns already tested; (2) new columns of extra-heavy material, both of the Bethlehem H-section, type 5, and of the built-up I-section, type 1, show the effect of heavier material, and (3) long columns of slenderness ratio 155 widen the scope of the inquiry.

The results are indicated in the accompanying table. In addition, there are included a set of tests of Carnegie mine-section H-columns, consisting of light columns donated to the bureau as mentioned in the last report.

The fact that the ultimate strength of heavier sections for the new short columns, of $l/r = 20$, exceeded that of the light sections does not tell the whole story. As in the case of the retested columns reported last year, the yield points of these new columns reverse this relation. These yield points average 26,000 for the heavy sections and 31,700 for the light sections. Comparing the stress-strain curves with those of last year's report it is seen that approximately the same relative difference exists between the yield points of the light and heavy material for these short columns.

The extra-heavy Bethlehem H-sections, with a nominal area of 26.64 sq. in., show a marked falling off in ultimate strength for all three slenderness ratios. On the other hand, the extra-heavy plate and angle columns of 13/16 and 7/8-in. metal show very little reduction in strength when compared with the heavy sections tested last year.

Average Results of Tests on Steel Columns for Joint Committee

(Each value is the average of three tests)

Length ratio	Average ultimate strength in pounds per square inch: Light sections	Heavy sections	Extra-heavy sections
	Type 1—Built-Up I-Section		
20 Old	36,400	44,400	
20 New	38,200	43,600	
50	32,700	29,200	
85	31,200	28,100	27,700
120	28,300	25,400	
155	26,200	22,700	
	Type 2—Box Section—6-Inch Channels, 8-Inch Plates		
50	33,900	32,300	
85	32,600	30,600	
120	29,300	28,100	
155	26,500	24,900	
	Type 4—8-Inch I-Beam and 2 Channels		
50	36,900	29,100	
85	34,000	26,600	
120	31,900	23,900	
155	23,600	23,300	
	Type 5—8-Inch Bethlehem H-Section		
50	38,000	35,400	25,200
85	34,300	32,300	23,500
120	32,000	30,000	21,300
	Carnegie Mine Sections		
	Light sections: 6-in. H	8-in. H	
50	31,000	33,500	
85	30,400	31,700	
120	27,200	29,200	

Results of Tensile Tests of Metal in Specimens from Columns

Area of columns, square inches	Thickness of specimen, inches	Yield point, pounds per square inch	Ultimate strength
	Type 1—Built-Up I-Section		
11.47	0.31	37,000	57,100
22.19	0.62	32,000	55,600
28.61	0.81	33,000	57,000
	Type 5—8-Inch Bethlehem H-Section		
9.17	0.32	38,000	59,000
18.27	0.55	33,000	57,500
26.64	0.78	26,000	56,500

As the results for the high slenderness ratio of 155 had only just come to hand, the committee published them without comment. The investigations are now complete with the exception of three columns ordered for a preliminary investigation concerning eccentric loads. The problems presented by the tests thus far made in this investigation have produced so many complications that the committee has asked the Bureau of Standards to study the question of procedure. Supplementary tests on short columns cut from previously tested columns were made, but the committee deemed it unnecessary to make abstracts of these tests, as the ultimate strength is hardly a factor for such short sections.

To determine whether the lower strength of heavy sections is caused by the metal itself, tensile and compressive tests have been made of specimens cut from

the webs of the Bethlehem H-sections and from outstanding angle legs of built-up I-sections for the tensile tests and of 5 x 3-in. angles for the compression tests reported.

The results of tensile tests are indicated in the table herewith, the stress-strain diagrams not being reproduced. The compressive tests on angles of length ratio 12.7 gave a yield point of 35,000 for the angle of 2.41 sq. in. area (5/16-in. thick), and 29,500 for that of 4.61 sq. in. area (⅝-in. thick).

These specimen tests indicate the difference in strength between thin and thick material. It would seem that the strength of the full-size columns is determined by the yield point of the specimen tests rather than by the ultimate strength. Apparently the tensile and compressive tests agree in showing the same relative yield points.

The committee points out the close relation which exists between yield point of the metal and the ultimate strengths of columns, and states that one of the first questions to settle is what shall be taken as the yield point of the metal. Reference is made to the discussion on yield point by the American Society for Testing Materials (see Engineering Record, July 15, 1916, page 78); modifications of some of the methods there suggested have been considered and the committee hopes that the data now being accumulated will assist in determining a practical solution.

A field of inquiry which is comparatively unexplored, according to the committee, is opened up by the question whether the same method for yield-point determination of the specimens can be applied to the columns, or if not, how this point shall be located. It is noted that the stress-strain curves of short columns show the rate of compression after the load has passed the yield point to be such that the column has ceased to have structural value above this point.

The questions of deformation point and ultimate strength, of safe working values, and the influence of lattice bars, tie plates and end connections, or the effect of details, yet remain to be determined. The committee hopes to formulate recommendations for designing columns during the coming year, and expresses appreciation of the cordial co-operation and assistance of S. W. Stratton, director, and G. R. Olshausen, engineer-physicist, of the U. S. Bureau of Standards. George H. Pegram is chairman and Lewis D. Rights is secretary of the committee.

Railway Coaches Equipped as Camp Buildings for Lumber Crew

Standard-Gage Cars Include Kitchen, Bunk Rooms, Blacksmith Shop, and Engineers' Office in Mobile Units

ARRANGED and equipped to replace the usual temporary camp used by a logging crew while getting out timber, twelve standard gage railway cars were built in 1914 for the Cherry Valley Timber Company of Everett, Wash. They include kitchen, dining and bunk rooms for the men, blacksmith shop, engineers' and administrative offices, as well as equipment for heating, lighting and water-supply systems.

The company handles its logs on a steam railroad. Before the completion of the logging operations which are contemplated the rail line will tap every part of the woods. It was therefore feasible to construct the camp equipment in cars that could be moved about as the work advanced, and which would afford conveniences not found in the usual temporary camp. With cars the camp cost is lower, when the time required to complete the work is taken into consideration.

THE CAMP BUILDINGS CONSIST OF SPECIALLY DESIGNED STANDARD-GAGE RAILWAY CARS, FULLY EQUIPPED

The first camp built on this plan was so successful that an order for another twelve cars was placed, and a new camp, much like the first, is soon to be in use. As a result of experience with the first camp, the design of the new cars was slightly modified.

The new cars are all 14 x 60 ft. in plan, except the kitchen, which is 14 x 36 ft. From rail to sill the height is 4 ft. 7 in., from sills to eaves the height is 10 ft. 2 in., and from eaves to clearance 3 ft. 10 in., making a total of 18 ft. 7 in. over all.

The camp is heated by a 35-hp. Scotch marine boiler burning oil supplied from a 2115-gal. steel tank in the engine room. This boiler supplies steam which heats all of the rooms except the storerooms. A 3½-kw. dynamo provides current for 164 lights, most of which are equipped with 16-cp. Mazda lamps. In the blacksmith shop a drill press and an emery wheel are driven by a 3-hp. motor. One entire car is devoted to bath and dry rooms. This car is equipped with a separate heating system, so that the hot-water supply there is independent of the boiler plant. The dynamo room is 14 x 14 ft. in plan, the boiler room 14 x 20 ft., and the blacksmith shop 14 x 26 ft., these three rooms all being contained within one 60-ft. car.

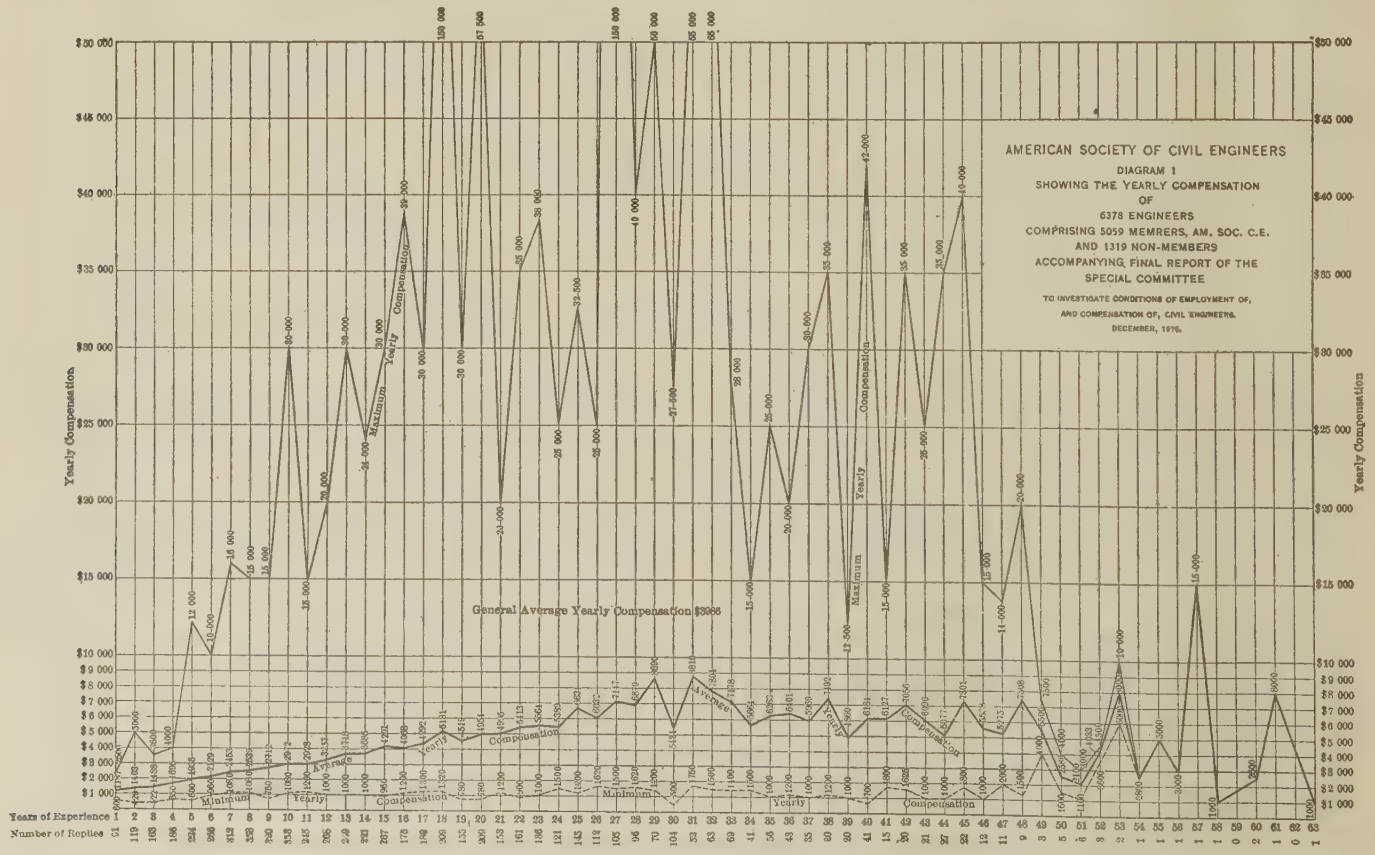
Engineer Salaries as High as Those of Other Professions, Says Committee

Investigation by American Society of Civil Engineers Indicates Annual Average Compensation of $3,986—Engineer Employers Underpay Their Men

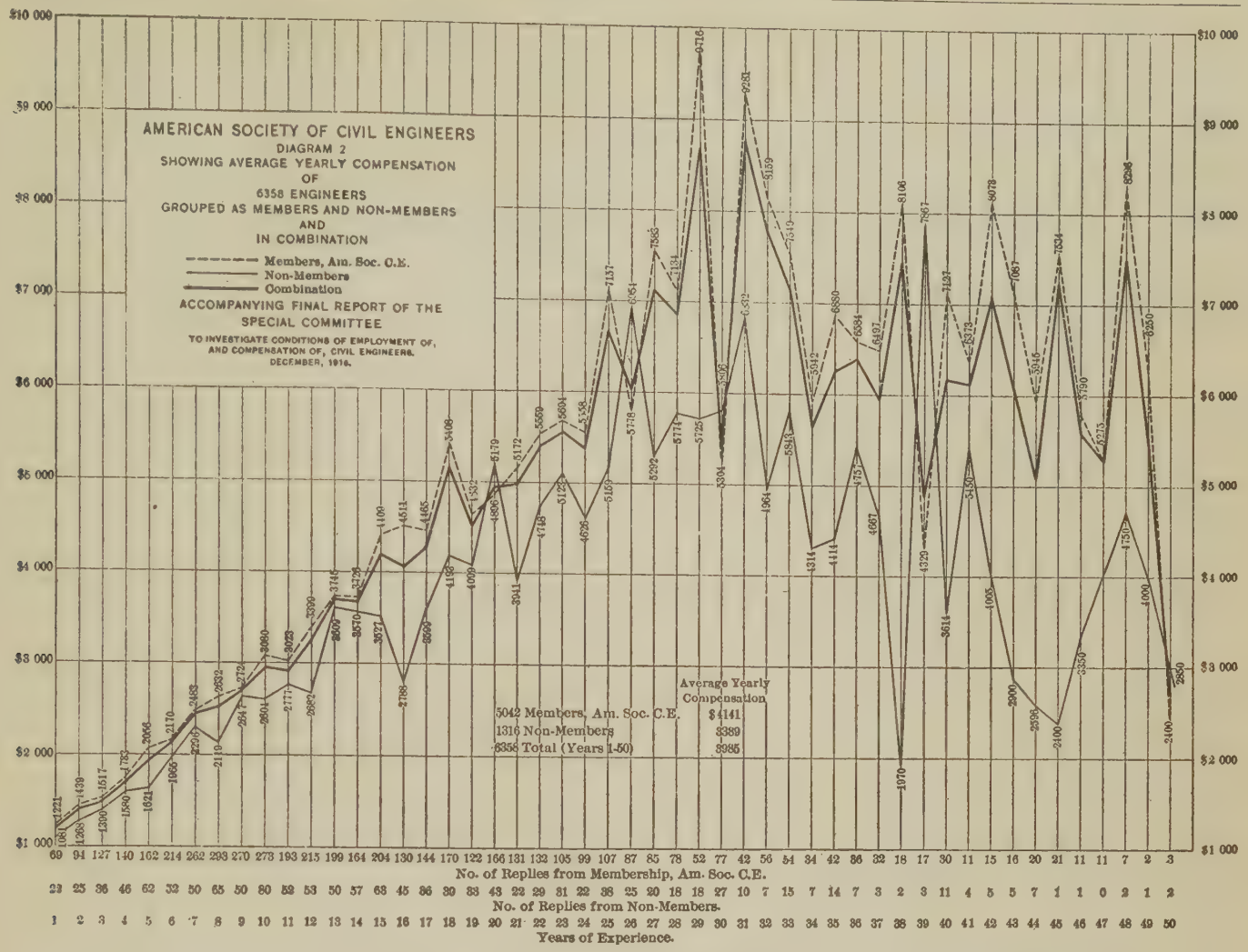
IN its final report in the December, 1916, number of the *Proceedings*, page 1603, the special committee of the American Society of Civil Engineers, appointed to investigate the compensation of members of the profession, reaches the conclusion that "the compensation for engineering work compares favorably with that received by men of any other profession," although in arriving at the annual average individual compensation of $3,986, based upon reports from 5059 members of the society and 1319 non-members, no consideration is given to the salary schedules of such large employers of technical services as railways and other corporations, municipalities, states and federal departments, from whom, the committee states, "it has not been possible to secure any information of value." A comparison of the diagrams in the final report with those previously submitted (see Engineering Record of Jan. 30, 1915, page 139) shows, according to the committee, no substantial changes, in spite of the broader scope of its later work. Underpayment of engineers, the committee points out, is often the fault not of an unappreciative public but of their own engineering superiors in office. Except during the first five years of practice, technical-school graduates receive higher compensation than non-graduates. As for compensation by classes, contractors are the largest moneymakers, followed by consulting engineers, engineers in private companies, railroad men, members of technical-school faculties, municipal employees, federal government employees, and, finally, employees of states and counties. The committee, from whose report the following extracts are taken, consisted of Nelson P. Lewis, chairman; John A. Bensel, S. L. F. Deyo, Dugald C. Jackson, William V. Judson, C. F. Loweth, and George W. Tillson.

During the summer of 1915 the committee addressed the same questions which were addressed to those whose replies formed the basis of its last report to those who had become members of the society since the last preceding circular was sent out, the number of inquiries so sent being 599, from which 263 replies were received. Inquiries were also addressed to 6393 non-members of the society, whose names were secured from the membership lists of fifteen local engineering organizations in different parts of the country. From these non-members 1319 usable replies were received, which, together with the additional members of the society heard from, brings the total number of returns received by the committee to 6378.

The committee has considered the advisability of addressing letters of inquiry to members of the other national engineering societies, but has concluded that this would be inexpedient, for the reason that there are



1—MAXIMUM, MINIMUM AND AVERAGE COMPENSATION OF 6378 ENGINEERS, INCLUDING 1319 NON-MEMBERS OF THE SOCIETY



2—COMPENSATION OF 6358 ENGINEERS, SHOWING COMPARISON BETWEEN MEMBERS AND NON-MEMBERS OF THE SOCIETY

quite a number of members of these societies who are also members of the American Society of Civil Engineers, and they are probably those whose compensation or income from professional work is above the average, so that, if those who are members of this society were excluded, the result would not indicate the average compensation of members of the other societies, and might be misleading.

Low-Salary Data Lacking

The committee also made an effort to secure information from the different engineering schools, but it was found that, with two exceptions, the statistics collected by these institutions concerning their graduates, with respect to the matters which have been the subject of the committee's investigations, were so incomplete that this idea had to be abandoned. An attempt was made to secure pertinent data from officers of railway and other corporations, municipalities, states, and federal departments which employ large numbers of engineers, but they appeared to consider it impracticable to undertake the collection of such data for the committee, and, without their active co-operation, it has not been possible to secure any information of value.

The committee, therefore, is obliged to base its third report on the information received from the 6378 engineers who have replied. That these figures are worthy of serious consideration is obvious from the fact that the 5059 members of the society represent a gross annual professional income of not less than $20,952,952, while the 1319 non-members represent a gross annual income of $4,467,709, or a total for those whose replies form the basis of the report of $25,420,661.

The returns from the 263 additional members of the society, the great majority of whom were younger men, when combined with those covered by the last report, result, as might have been expected, in lowering the average compensation from $4,224 to $4,142, or $82. The average annual compensation of the 1319 non-members is $3,387, or $755 less than for the members of the society, including the latest returns. The committee realizes that in directing its inquiries to individuals outside of the membership of the society, but members of local engineering organizations, it has addressed a number of men who are not really practising engineers, as the local engineering organizations almost always include in their membership men who may be simply interested in engineering and some who have done little, if any, professional work, and they have been frank enough to say so in their returns, and their replies are not included in our statistics.

Twenty-two of the replies indicated that the men who made them are employed as sales engineers or in other lines of commercial work, although they are graduates of engineering schools. These men appear to have turned their attention to this kind of work immediately

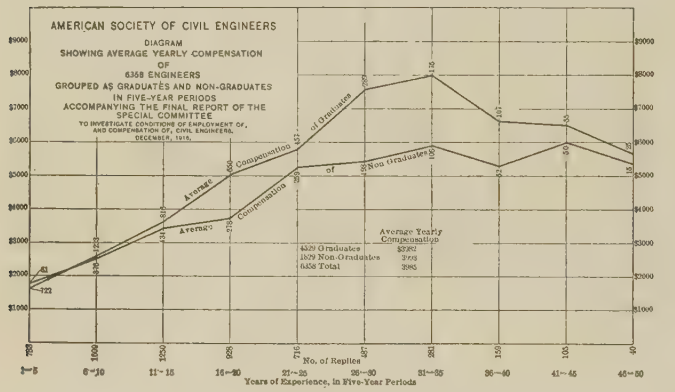
after graduation. The committee has not included these returns in its compilation, but they are so significant as to be deemed worthy of comment. They include men whose active work covers periods of from 1 to 22 years, although in all but four instances their experience in work of this character has been 10 years or less. A comparison of their earning power with that of men engaged in what is generally considered to be strictly engineering work indicates that it agrees very closely with the averages shown by the diagrams, even though the responsibilities which must be assumed are less than those of the practising engineer.

Five Diagrams Submitted

The committee submits five diagrams, as follows:

1. A diagram similar to that reproduced as Plate XL in the last report (*Proceedings*, American Society of Civil Engineers, Dec., 1914) showing maximum and minimum average annual compensation for professional work of 6378 engineers, including 1319 who are not members of the society.

2. A diagram showing the average yearly compensation of 6358 engineers, divided into members of the



3—WHAT GRADUATES AND NON-GRADUATES EARN

society and non-members, together with the combined average.

3. A diagram showing the average compensation of graduates and non-graduates, arranged according to 5-year periods.

4. A diagram showing the average compensation of engineers grouped according to nature of service.

5. A diagram showing the average compensation of engineers arranged in six geographical groups.

The first diagram includes all the returns which have been received. The second and third include all returns covering professional activity of 50 years or less, while the other two cover all those which are capable of being classified with certainty and which include 40 years or less of professional work.

Effect of $25,000 Incomes

The committee has considered the question as to whether exceptionally large professional incomes, say those above $25,000 a year, might not be due to some fortuitous circumstance or condition entirely apart from professional ability, and whether they should not be excluded from consideration in the preparation of the diagrams by arbitrarily reducing them to $25,000. This was tried, and, while the effect was to modify very materially the curve showing maximum professional incomes, its effect on the curve of average compensation was very slight. The committee believes that the data collected include practically all the very large professional incomes, and that an increase in the number of returns would tend to eliminate the irregularities of the curve. The committee's conclusion has been that the returns should be shown as they were received.

A comparison of the diagrams with those presented with the last report will show that the broader scope of the committee's inquiry has not produced any substantial changes in the results heretofore submitted. The line indicating the average compensation of non-graduate engineers falls below that showing the compensation of graduates, except during the first part of the first 5-year period, where the professional earnings of non-graduates appear to be slightly greater than those of graduates. The committee has communicated with bodies which are collecting data concerning professional education, in the hope that it might secure information relative to the compensation of men engaged in other kinds of professional work. Its inquiries have not produced any definite results, and, so far as the committee can learn, no data as complete as are herewith presented have been secured with respect to them. From such meager information as was obtainable, the committee is convinced that the compensation for engineering work compares favorably with that received by men of any other profession. Engineers, like other professional or business men, are frequently desirous of being connected with important undertakings which will give them valuable experience and a certain prestige, and, in order to gain these, they are willing to accept salaries which are very small in comparison with the value of the services rendered.

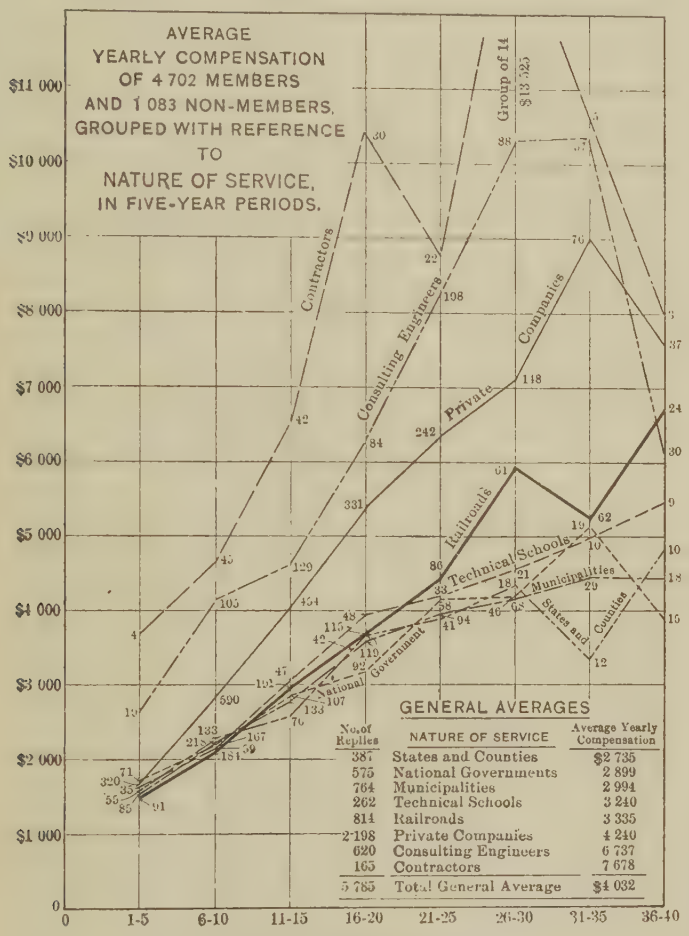
Engineers Underpay Their Own Men

The underpaid engineer does not always owe his failure to receive a salary commensurate with the importance or difficulty of his work to the ignorance or lack of appreciation of laymen, but it not infrequently is the fault of his engineering superior in the organization of which he is a part. The replies received by the committee indicate that engineers in private practice sometimes employ men of extensive experience, and presumably of good ability, at salaries which young graduates with little or no experience are able to command, but which are less than those of an ordinary mechanic who has a labor organization behind him.

It may be urged that the competition for work on the part of engineers who employ a technical staff is so keen that it is necessary to take advantage of the needs of those seeking employment in order to secure professional work which is frequently let to the lowest bidder. Engineers in private practice are often criticized because they have not established a scale of charges on a percentage basis as have the architects, but in the offices of leading architects will be found young men who are willing to work for almost nothing for the sake of the experience they hope to gain. The fact remains that employing engineers are sometimes disposed to pay their men less than their services are actually worth. The Code of Ethics, adopted by the society by letter-ballot on Sept. 2, 1914, lays special emphasis upon the relation of the engineer to his client and to that of competing engineers, who may be striv-

ing to secure the same contract or commission, toward each other, but it makes no mention of the obligations of the engineer as an employer to men of his own profession. It appears to lose sight of the need of guarding against underpaying and underbidding.

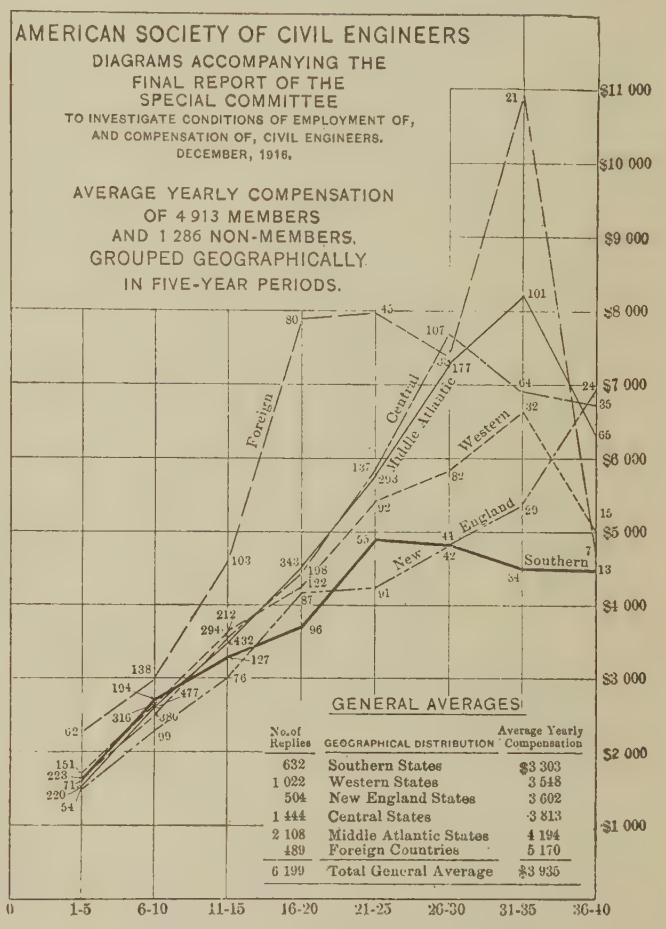
The engineer, in some branches, unlike other professional men, is frequently unable to locate in one place until he can become known, even though his reputation may be local. He must go where work is in progress, and, when the particular work on which he has been engaged shall have been completed, he must move on to another place. Periods of unemployment are fatal to steady advancement, while a reasonable prospect of promotion, however slow, is likely to prompt men to accept less than the average compensation for the kind of service rendered.



GENERAL AVERAGES

No. of Replies	NATURE OF SERVICE	Average Yearly Compensation
387	States and Counties	$2 735
575	National Governments	2 899
764	Municipalities	2 994
262	Technical Schools	3 240
814	Railroads	3 335
2 198	Private Companies	4 240
620	Consulting Engineers	6 737
165	Contractors	7 678
5 785	Total General Average	$4 032

4—HOW NATURE OF SERVICE AFFECTS PAY



GENERAL AVERAGES

No. of Replies	GEOGRAPHICAL DISTRIBUTION	Average Yearly Compensation
632	Southern States	$3 303
1 022	Western States	3 548
504	New England States	3 602
1 444	Central States	3 813
2 108	Middle Atlantic States	4 194
489	Foreign Countries	5 170
6 199	Total General Average	$3 935

5—LOCALITY AS A FACTOR IN COMPENSATION

Engineer Supply and Demand

In reading the observations made by those who have commented upon the compensation of engineers and the conditions of their employment, it has appeared to the committee that many of those which appear cynical or pessimistic have been made by men who would probably have been failures in any occupation or profession, men who do not possess adaptability or even a fair degree of industry, and who attribute their failure to their unfortunate selection of a profession. These comments should not be given much weight. Perhaps there are too many engineers, but the eagerness of young men to adopt this profession is doubtless due to the indisputable fact that young graduates of engineering schools reach a self-sustaining basis, where they are at least able to support themselves, more quickly than do those of other professions. Much has been said lately about the general decrease in the registration at engineering schools, and this has apparently been viewed with alarm by their faculties. The committee does not consider it a bad omen for the profession. There is a need of better trained engineers rather than of more engineers, a need more particularly of men who are better grounded in the fundamentals of the engineering sciences and who have at the same time acquired some knowledge of the economic or business aspects of engineering work, rather than of men who may have the greatest earning capacity on the day of their graduation.

Holding Power of Nails

A few experiments to determine the holding power of 16d. and 20d. nails in a direction perpendicular to the length of the nail were made recently by J. C. Stevens, consulting engineer, of Portland, Ore. Ordinary 2 x 12-in. yellow-pine planks were nailed to fir sills and then sheared off. From these experiments a safe loading of 210 lb. for 16d. and 250 lb. for 20d. nails was assumed for use in the heel plates of the wooden flumes on the West Okanogan irrigation project, described in the Engineering Record of Nov. 25, page 640. These figures are believed to be higher than usual.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Army Engineer Corps Aids in Flood-Relief Work

SIR: Following the great storms of July, 1916, which did such damage in the states of North Carolina, South Carolina, Georgia, Alabama, Florida and Mississippi, Congress adopted a joint resolution appropriating $570,000 and authorizing the Secretary of War to provide relief for the sufferers.

The resolution set forth three methods for furnishing relief:

1. By supplying such seeds as may be suitable to produce quick-growing crops to provide food for the population and animals.

2. By providing employment under the supervision of army officers and in co-operation with local officials.

3. By furnishing supplies of the Quartermaster and Medical Department for a limited time to those who are destitute and unable to work.

The quick-growing seeds were supplied through the Agricultural Department, and all other relief measures were administered by the Secretary of War through the Engineer Corps of the U. S. Army.

The devastated sections were almost entirely agricultural, and owing to local conditions the problem was one of helping the people over a period of three or four months that must be lived before they could begin to realize on new crops.

Great care had to be exercised in the administration of relief to prevent pauperization. All applicants for free supplies or medical attention were subjected to careful examination and investigation to prove that they were both destitute and unable to work. The amount of such free supplies issued was relatively small. Most of the relief was given by employing the destitute on road work, there being not enough river improvement or other public work of the United States to furnish employment to the destitute in the stricken localities.

The road work was carried on in co-operation with the state, county, and other local officials. Only those actually destitute were employed, and, more fully to safeguard the United States against abuse of its effort to help the deserving, the wages paid were fixed at from 50 to 75 per cent of the current wages in the locality.

The work on the roads was confined almost entirely to grading and drainage by hand labor, as in that way the greatest benefit could be derived, and practically all the money expended went direct to the laborers, very little being needed for the purchase of material.

W. M. BLACK,
Chief of Engineers, U. S. Army.

Washington, D. C.

[The success of the efforts of the government is attested by the following letter sent to General Black by Senator Underwood of Alabama.—EDITOR.]

MY DEAR GENERAL BLACK: I write this letter to express my thanks to you and the other members of your corps who accomplished the great work of relieving our people in Alabama from the flood situation last summer. The work was splendidly done. The relief was immediate, and accomplished the results desired without bringing any demoralization in its wake. Our people were thoroughly satisfied with its accomplishment, and I have heard no complaints and only praise of the efficient and capable way in which you and the members of your corps handled the situation.

With kindest regards, I am,

Cordially yours,
O. W. UNDERWOOD.

Federal Support for Research

SIR: I have noted with great interest your editorial of Nov. 25 upon "Leadership Through Industrial Research." I am glad also to take this opportunity to express my gratification of the fact that your paper does not hesitate to take and express a statesmanlike and far-seeing position in all those matters which affect the engineering profession at large. I trust that you may continue and extend this policy in the future.

My special purpose in writing, however, is to invite your attention to a certain bill now in congressional committee and to ask your assistance in bringing it to the attention of engineers generally. I refer to the Newlands bill, Senate No. 4870, in charge of Senator T. P. Gore, committee chairman. As originally presented, this bill provides a lump-sum appropriation of $15,000 annually to each of the agricultural and mechanical colleges of this country for engineering research, the same being a continuation of the policy of the Morrill act. The fact has developed, however, that there were doubtless many engineering schools other than the agricultural and mechanical colleges, including state universities and privately endowed schools, which are in a better position to carry on engineering research than these schools alone.

At a recent meeting of the Association of State University Presidents, a majority of whom were in charge of agricultural and mechanical colleges also, it was decided to recommend amendments to the bill in at least two important particulars:

First, to provide for a central governing board which should decide what investigations would most benefit the nation at large, and as a corollary to determine to what available school or group of schools a given problem could most properly be assigned.

Second, that the total amount of money provided should not be made available the first year, but that ten selected institutions should start the work, and five more be added annually until the whole appropriation was being absorbed.

The main principle seems to be that there is not any inherent or logical reason why federal aid should not now be properly extended to general engineering research, under the most favorable conditions, as well as to the agricultural interests exclusively, which was doubtless the guiding aim of the Morrill act.

If you feel that this is a subject in which you can properly interest yourself, and we confidently believe that you do, we trust that you will take appropriate action in the near future, as the bill is expected from the committee at an early date.

JAS. I. TUCKER,
Professor of Civil Engineering, University of Oklahoma.
Norman, Okla.

[In discussing this bill, March 25, 1916, page 405, the Engineering Record held that the states should furnish the money for the stations themselves, or that at least the states should match the federal appropriations dollar for dollar. The need for central supervision was also emphasized. We are glad to note that the colleges have agreed to modify the bill in accordance with the last suggestion. We still hold, however, that government money should be given as encouragement only—a means whereby the states themselves will be induced to finance engineering experimental work.—EDITOR.]

Motor-Truck Regulation and the Protection of Road Surfaces

SIR: Concerning the discussion of highway regulations for solid-tire, heavy trucks, whether horse-drawn or self-propelled, I would like to call attention to the fact that although the fixing of maximum loads in terms of width of tire will accomplish good, it is not altogether a complete nor a practical way of securing best results. Assuming that the wheels have a solid rim, there is somewhere a practical limit to the width of tire beyond which further widening will not obtain results comparable with the results obtained before such limit was reached.

Since, in general, road surfaces are either irregular or convex, it is evident that a cylinder rolling along such road will not be in full bearing throughout its lower elements, but that the load will be concentrated more or less completely on certain parts of such elements. It is possible, moreover, that at sharp turns the wide tire may prove objectionable.

If width of tire were the sole legal requirement it probably would be necessary in the case of very heavy loads (in order to secure adequate protection to the road surface) to have the wheel built up of several disks, more or less independent of one another, and with independent tires. These would have to be attached to the axle by some kind of adjuster so that the tire of each disk would carry a reasonable part of the total wheel load. Otherwise, undesirable concentration of wheel load would not be obviated by simply widening the tire. The construction of a wheel made up of several disks would be costly and might not be practical.

In the case of the pneumatic tire this adjustment is given automatically and very satisfactorily by the tire itself, although the pneumatic tire does have the unfortunate habit of picking up or chafing off the smaller particles of the surfacing material of the road. This removal of the small particles of binding material is ordinarily assigned wholly to "suction," but it is probable that it is partly due to the lateral movement of certain parts of the lower elements of the pneumatic tire resulting from the temporary deformation of the tire under load, and this movement of the tire on the road is not entirely dissimilar to the movement of a rubber eraser on a piece of paper.

The "suction" does undoubtedly assist in the destruction of road surface by lifting up and transporting for a short distance the particles detached, so that they will not settle back into place. It seems, therefore, that merely increasing the width of tires will not give the desired protection; and it is suggested that the increase in the diameter of the wheel itself may accomplish a great deal more than a great increase in the width of the tire.

Some highway engineers have pointed out how the road metal is "hammered" by a heavy truck in order to bring out the effects produced by wheels of different diameters. It might be interesting if some one who has time to do so would compare the hammering effects of, let us say, a 24-in. wheel and a 72-in. wheel, both carrying the same load and moving at the same rate of speed when they strike an obstacle 3 in. high and having a vertical face toward the oncoming truck. Different cases may be assumed: (a) The wheel is without friction at the axle; (b) the wheel has friction of some assumed amount at the axle tending to cause the wheel to slide along the road; and (c) the wheel is a propelling wheel of a truck with some assumed rotative force applied to the axle.

The difference, if any, of the direction of the action lines of the hammering forces at the instant of impact developed by the two wheels, as well as the intensity of the forces themselves under the various assumptions, would prove interesting. The horizontal component of the hammering forces may be a large contributing cause to the destruction of roads by raveling out the surface and starting ruts and chuck holes. It might be well, also, to extend the investigation to include four-wheel vehicles, so as to bring out what effect on the road is produced by changes both in tread and in wheelbase.

It is probable that the four elements of design here referred to—width of tire, diameter of wheel, tread, and wheelbase—should all be held within certain practical maximum and minimum limits. On the other hand, it might be a good thing to require builders of vehicles designed for wholly different purposes to adopt different dimensions for the above elements, even including that of tread. In other words, vehicles should be arranged into classes according to size, purpose, weight, speed, etc., and certain maximum and minimum limits should be fixed for each class in the elements of design.

As to the use of steel tires versus solid-rubber tires, this is something that evidently needs very careful consideration. Perhaps an increase in wheel diameter, or some other change in design, may justify the retention of the steel tire. One of the important contributing causes to road destruction by a vehicle of given design is the product of load and speed, or the product of the load and some power of the speed. It is prob-

able that the roads can be conserved better by placing a speed limit on the trucks than by merely changing width of tire.

As to the use of trailers, it would seem that, everything else being equal, any increase in the tractive effort of a truck must increase the horizontal component of the force applied by the driving wheels to the road surface and must hasten destruction by raveling or grinding away that surface. If an overloaded locomotive can destroy heavy steel rails in a short time, it would seem that a road surface practically devoid of tensile strength must rut badly under the wheels of a heavy motor truck hauling heavy trailers.

In the present development of the motor truck hauling trailers, electric drive is not used; but if there is to be any great development of this form of transportation it would seem that in the interest of road maintenance it might be advisable to have some of the wheels of each vehicle apply the tractive effort needed for its own propulsion, and electric drive lends itself particularly well to this change.

The use of corrugations or projections on the tire may be necessary on unimproved roads or for what is practically cross-country work, especially on icy ground; but it would seem that their use on improved roads should be prevented. In case of ice, wheel chains could be used temporarily.

In view of the generally unsettled state of world politics it would be well for highway engineers to ascertain from the War Department the probable maximum military load before adopting highway regulations and bridge designs. It is understood that the present war in Europe is bringing out some new data on the subject. It would be unfortunate for the highway engineers of any section, particularly of New Jersey, to adopt such restrictive designs or regulations as would lead to the construction of roads and bridges wholly inadequate for military needs.

In summing up, it is suggested that road regulations should not be adopted without full consideration of the following points of design: (1) Width of tire, (2) diameter of wheel, (3) tread or length of axle, (4) wheelbase or length of vehicle, (5) character of tire, (6) use of trailers, (7) permissible speed, and (8) permissible wheel load and load of entire vehicle.

One thing seems certain: In the present state of highway improvement, as well as of motor-truck development, it behooves the motor-truck owner to be very careful to avoid unnecessary damage to improved roadways. If he is not, the development of good roads will be greatly retarded on account of the unforeseen and excessive cost of upkeep, and this will lead to the denial to motor-truck owners of the use of country roads.

The problems pertaining to the construction and maintenance of good roads are generally ignored by the public at the present time. It is quite the vogue to be enthusiastic over good roads without thinking much about the disagreeable subject of road maintenance. There seems to be a general air of blind hopefulness that the good road, once built, will somehow maintain itself. Until the public is thoroughly educated to the point where it will candidly face the serious questions of adequate maintenance of the good roads now built or contemplated, it would be well for the motor-truck designers and owners to see that the motor truck is not made the scapegoat when the day of lamentation arrives.

W. L. GUTHRIE,
Major, Corps of Engineers, U. S. Army.
Mobile, Ala.

SIR: I have followed with a great deal of interest the numerous articles which have appeared in the Engineering Record in the past fifteen months on the regulation of motor traffic on streets and highways. Every highway and municipal engineer can cite numerous instances of practical destruction of certain classes of pavements by large motor trucks. In many cases pavements which have withstood ordinary traffic for years suddenly begin to fail when some temporary local condition routes a string of material trucks over them.

Fortunately, highway construction has practically just begun in the central states west of the Mississippi, and engineers will undoubtedly profit by the experience in the East and not build types of surfacing totally unsuited to any great amount of automobile traffic. There is a limit of endurance to every class of pavement, however, and there is no doubt that a few users of our pavements will, if unregulated, destroy large investments which would lend satisfactory service to the large majority if this abuse were not allowed.

Some regulation is also necessary to enable engineers to design economically for the future. All such laws should be based on three principles: First, they should be easily and equitably enforced; second, they should allow for natural industrial expansion, and third, they should be flexible enough to provide for changes in character of traffic and improvements looking toward the greater efficiency of this operation. New Jersey's law fails in all three of these respects. If it were possible at all to enforce many of its provisions the cost would be prohibitive and the results far from equitable. The speed governor and the provision for way bills of each load are thoroughly impracticable, as are a number of other provisions. Such requirements as rubber tires and only one trailer will handicap the development of freight hauling by motor trucks, instead of encouraging it as an economic benefit serving to decentralize our population and making a wealthier and more contented people.

In the third case, what would be the objection to a metal-tired wheel with a resilient hub and proper springs beneath the load, if a practical trailer of this kind should be placed upon the market? I believe that the proper way to regulate this class of traffic is to demand a license fee based upon the construction and capacity of the vehicle, making this fee on a sliding scale which would compel each vehicle to pay in accordance with the wear which it creates on the road surface. Vehicles over a liberal size and carrying capacity per wheel load should not be licensed, and in this connection it must be assumed that trucks will travel on the highway at times as fast as reasonable safety will permit. The provisions in the New Jersey law regarding size of wheel, width of tire and fee based on carrying capacity are sound and should be re-

tained, but I do not believe that they are liberal enough. A law should be framed to prevent unreasonable abuse without discouraging this class of traffic and the pavements built of a design and of materials which will withstand the heaviest expected regulated traffic.

CLARK R. MANDIGO,
Former Assistant City Engineer.
Kansas City, Mo.

How Soon Should the Surface of Concrete Roads Be Finished?

SIR: It is not the intention of the writer to advance any new idea, but rather to bring out an expression of opinion regarding the handling of concrete entering into a concrete road after it has left the mixer.

The methods of preparing the subgrade and the form of cross-section, crown, etc., seem to be pretty well established. Even the proportion entering into the mixture, which has been so widely discussed in the past, seems to be settled. But there remains one thing upon which engineers still differ—how shall the concrete be taken care of after it reaches the grade? Shall it be finished at once? Is the concrete better if some time elapses between striking and finishing?

The writer has noticed that many concrete roads lose a thin layer of surface shortly after being opened. The concrete below does not flake off like this top layer but "dusts" and does not seem to have the ability to resist wear although a strong mixture was used.

Some time ago a contractor who has put in a large number of concrete factory floors in Detroit stated that his success in building floors that do not "dust" is due to the fact that the concrete is finished immediately after being removed from the mixer. When asked if it wasn't hard to keep the finishers so close to the work, he stated that he considered this so important that the mixer was stopped if the finishers were getting behind until they caught up.

There is no question that some floors and concrete roads dust and ravel, and if immediate finishing is the solution of the former, why not of the latter?

The writer has often seen finishers working 75 ft. or more behind the mixer. Figuring that the gang lays 500 ft. per day, that means the concrete has been out of the mixer one and one-half hours. What is the effect when the finisher retempers the mortar in floating so long after it has been mixed? The initial set has been destroyed. Most specifications for concrete construction to-day call for the rejection of concrete that is not deposited in the forms within 30 minutes. The concrete road calls for more exacting specifications than building construction, for, in addition to shear, tension and compression, we have abrasion. We, therefore, should not be lax in road specifications. The finishers should not be more than 25 ft. behind the machine, if initial set is to be allowed to take place uninterrupted 30 minutes after mixing.

Some time ago an experiment was made to obtain a more even surface. A hand strike was sawed six times over a 25-ft. section of road, after which it was finished with a hand float. It looked beautiful to the eye—so even—but shortly after traffic was turned onto it a layer about ⅛ in. in thickness came off, exposing the pebbles beneath. The exposed concrete was hard through the tamping caused by the excessive striking, but the top layer which was continually disturbed by the strike lost its initial set and the bond to the lower material.

The chemical action of "setting" in the cement begins as soon as the cement comes in contact with the water. We should continue mixing the aggregates, cement and water up to a certain time, not to increase the chemical action, but to mix the ingredients thoroughly so as to get an even quality of concrete. It is found if we mix longer than this time we get a weaker quality of concrete. Why? Because we had it mixed and the continual turning of the drum is interfering with the setting.

Let us assume that we have turned it over in the mixer drum just the right length of time to get the strongest mix. We pour it out onto the grade, which is further mixing. Workingmen tramp into it, level it off and strike it, which is further mixing. Then after it has been out of the mixer an hour, along comes the finisher with a wooden float. He slushes the mortar top around in the excess water that has come to the surface, which is further mixing.

We have mixed the concrete in the drum until we have obtained the greatest efficiency out of the cement and then continued to mix or temper it, which experiments prove will decrease the efficiency. Then we come on and destroy the initial set by late floating. What is the result? Haven't you noticed the flakes that come off a concrete road soon after traffic is let on? That, together with continual dusting, is the result.

Many engineers agree that the concrete should be finished close to the mixer, and in order to do this easily they make the mixture very wet. The slushing of the excess water in the mortar with the float will not produce good concrete, to say nothing of the cement that has run to the sides with this water.

Mix your concrete dry by using the correct percentage of water. There will then be no excess water to evaporate and make voids in the concrete. It is true the striking, tamping and finishing of such concrete will cost more than the sloppy kind, but the wearing surface produced is worth ten times the cost.

Concrete roads will last indefinitely if destroyed through wear alone. Raveling is what destroys them, and that takes place when the hardness of the mortar is not on a par with the coarser aggregate and allows it to loosen and be picked out.

Mix your concrete the proper time, deposit it on the grade, crown and float it at the earliest possible moment, and let nature do its work uninterrupted.

EDWARD N. HINES,
Chairman, Board of County Road Commission, Wayne County (Detroit), Michigan.
Detroit.

Dish Concrete Roads on Grades

On concrete roads in the vicinity of Sioux City, Iowa, where 20 miles of 16-ft. width have been laid recently, the crown is eliminated on grades of 4 per cent and over, according to the *Iowa Service Bulletin*. The idea is to carry away the water rapidly and still not wash in the dirt shoulders and side ditches. At the foot of the hill a concrete runway carries the water off the roadway into the side ditch.

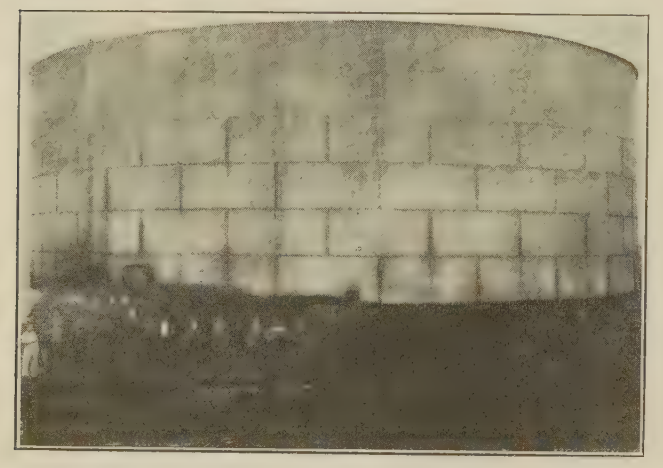
HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

CONTRIBUTIONS *to this section are solicited, and if found available will be paid for. They must be* SHORT, *and should be accompanied, if possible, by photographs or sketches.*

Ninety-Foot Diameter Oil Tank Moved Fourteen Miles on Pair of Barges

AN UNWIELDY oil tank, shown in the photograph, 30 ft. high and 90 ft. in diameter and weighing 120 tons, was recently moved intact on two barges 14 miles by water from Seattle, Wash., to Point Wells. On account of its large diameter, the two barges on which it was loaded, each of which was 34 x 90 ft., were spaced



NINETY-FOOT DIAMETER TANK LOADED ON TWO BARGES AND MOVED FOURTEEN MILES

16 ft. apart, and lashed to timbers lying across both decks.

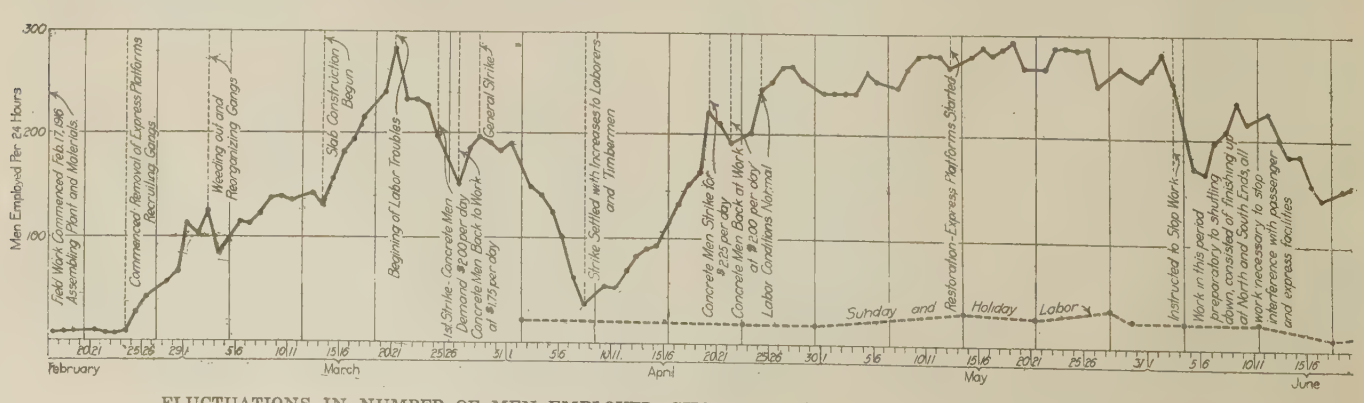
To raise the tank, which rested on a brick foundation level with the ground, four tunnels were driven from the circumference to the center, in which temporary timbers and jacks were placed, in addition to 30 jacks under the outside ring. The tank was raised in this way 4 ft. until six 12 x 14-in. cross-timbers running from side to side and two 16 x 18-in. running timbers at right angles to them, and symmetrically located 50 ft. apart, could be placed. The runways under these stringers were each made of three 6 x 6-in. timbers, placed on 6 x 6-in. blocking. The tank was moved about 800 ft. on these runways, using sixty 8-in. maple rollers, by a team of horses and a capstan. The track extended over the deck of the scows, and was arranged so that the section on the scows was level with that on shore at high tide. The tank was started on to the scows about 1 hour before high tide, so as to have ample time for loading before the tide receded too far.

The tank was towed to Point Wells by a tug, where the loading operation was reversed, the tank being taken off at high tide and moved about 300 ft. to new foundations.

The tank, which belongs to the Standard Oil Company, has a capacity of 1,424,270 gal. It required Olson & Nicholson, contractors, of Seattle, about 30 days to move it, and 75,000 ft. b.m. of timber was used for blocking.

Labor and Progress Charts Give Good Construction Record

THE CHARTS reproduced herewith show the close relation between the labor supply and the progress of the work during the construction of the concrete slab, built by the Long Island Railroad to safeguard its Flatbush Avenue terminal during future subway construction, and described on page 52 of this issue. The curve on the labor chart shows the number of men employed each day, and the progress chart indicates the expected progress outlined at the beginning of the work and the actual dates on which the different operations were carried out. Both show the slow start due to the difficulty of gathering an organization in the depleted labor market of New York City last winter. The serious delay to the work resulting a short time later from the strike of the subway laborers is plainly marked in the progress chart, while the actual reduction in the force is shown on the labor chart. When, after the work had recovered from the effects of the strike, it was deemed advisable by the Long Island Railroad to shut down work for a brief period, the labor chart plainly shows that the men laid off could not be replaced, and the effect of the reduced force with which it was neces-


Men Employed Per 24 Hours
300
200
100
Field Work Commenced Feb 17, 1916
Assembling Plant and Materials
Commenced Removal of Express Platforms
Recruiting Gangs
Weeding out and Reorganizing Gangs
Slab Construction Begun
Beginning of Labor Troubles
1st Strike - Concrete Men Demand $2.00 per day
Concrete Men Back to Work at $1.75 per day
General Strike
Strike Settled with Increases to Laborers and Timbermen
Concrete Men Strike for $2.25 per day
Concrete Men Back at Work at $2.00 per day
Labor Conditions Normal
Restoration-Express Platforms Started
Sunday and Holiday Labor
Instructed to Stop Work
Work in this period preparatory to shutting down, consisted of finishing up at North and South Ends, all work necessary to stop interference with passenger and express facilities
February
March
April
May
June

FLUCTUATIONS IN NUMBER OF MEN EMPLOYED, SHOWN IN LABOR CHART BELOW FOR ENTIRE JOB, REFLECTED IN

sary to complete the work is shown in the flattening out of the progress curves.

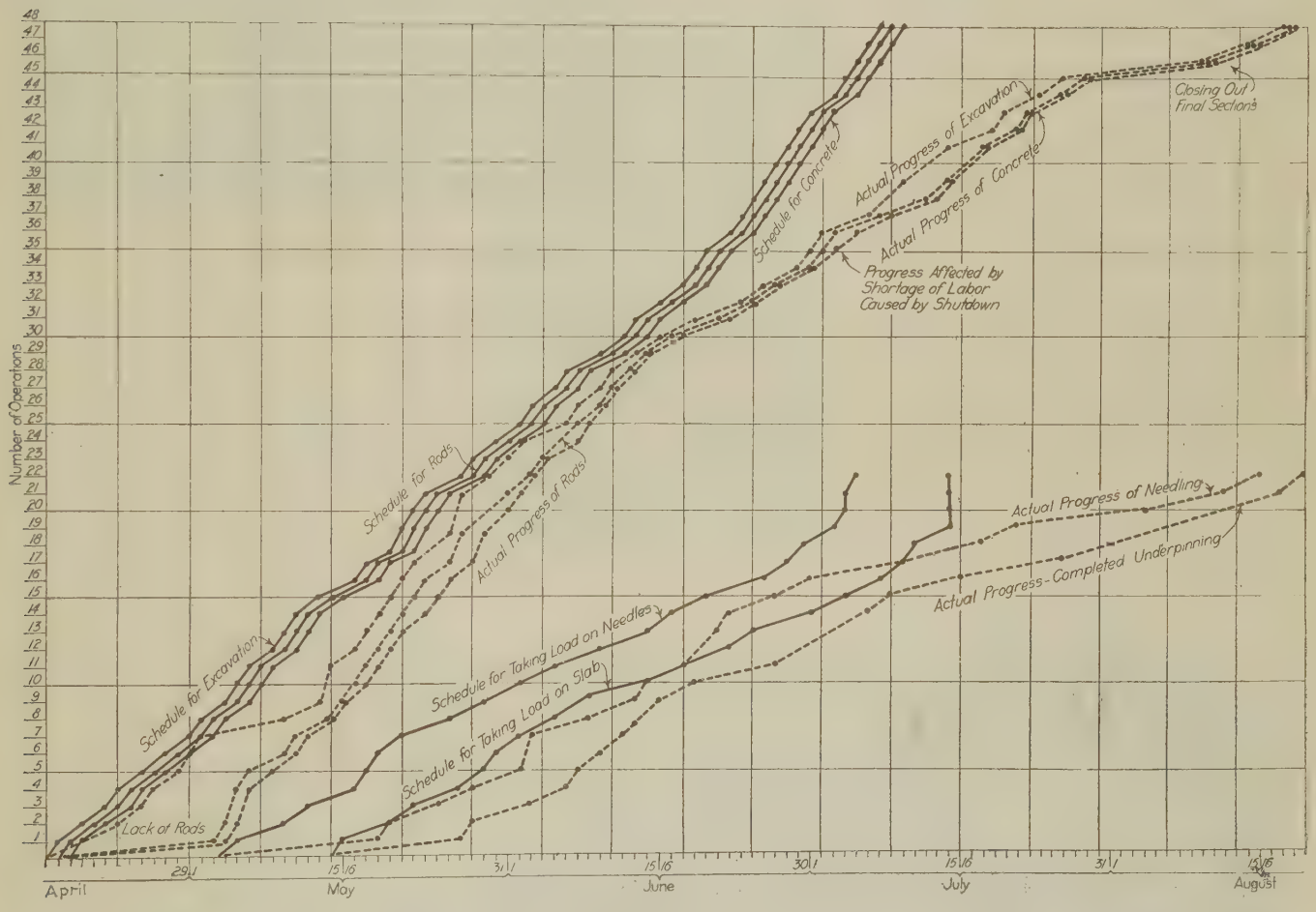
Needless to say, records of this kind are invaluable on much construction work, especially when it is of the rush order. The charts were made by James Forgie, who carried out the work as consulting and construction engineer in charge of a special organization for the Long Island Railroad Company.

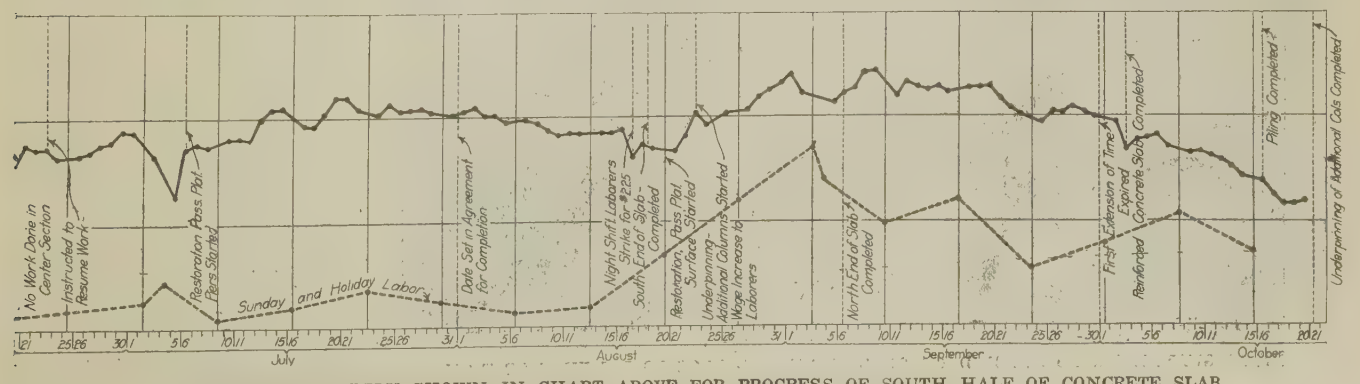
Reach of Dredge Increased by Supporting Bank Spud on Log Bridge

By RALPH BOSARD
Morgan Engineering Company, Memphis, Tenn.

IN EXCAVATING a ditch on drainage work in Tennessee with a dredge which could not deposit material at the desired distance while stationed in the center of the cut, and the bank spuds of which did not have sufficient spread to permit of taking the cut out in halves, the necessity for lengthening the boom and thus overstressing the dredge was avoided by using a log bridge from the deck of the dredge to the bank to support the spud on one side in making the second cut.

The work done on this drainage contract consisted of digging two laterals and a main ditch, the three having a total length of about 16 miles. The ditches are located in west Tennessee, about 15 miles north of Dyersburg, in what is known as the Reeds Creek Drainage District. The two laterals were of minimum size, having 14 ft. bottom width and ½ to 1 side slopes. The main ditch was specified to be of minimum size for the first 3½ miles, while for the next 2 miles a bottom width of 25 ft. with 1 to 1 side slope was required, and for the remaining 3½ miles a bottom width of 35 ft. with 1 to 1 side slopes and a depth of 10 ft. This made the top width 55 ft. The width of berm specified was 10 ft. on each side for this as well as for the other sections.





RATE OF COMPLETING WORK, PARTLY SHOWN IN CHART ABOVE FOR PROGRESS OF SOUTH HALF OF CONCRETE SLAB

The equipment installed by the contractor, a 1½-yd. dipper dredge with a 55-ft. boom mounted on a 30-ft. hull, readily handled all the material until the wide section at the lower end of the ditch was reached. Here it was not possible for the dredge to dispose of the waste material while in the center of the ditch. It was likewise impossible to shift the dredge from side to side and take the ditch out in halves, because the spuds did not span a sufficient width for excavating the second half. To increase the length of the boom would have overloaded the entire dredge and brought in excessive repair bills. Instead, the method shown in the photograph, of increasing the effective reach of the spuds, was devised.

This was done by bolting logs 22 ft. long, with a minimum diameter of 15 in., to the lower end of one spud. The logs were placed parallel, one on each side of the jack arms, resting at one end on the hull and at the other on the bank. The outer end of the logs, extending some 7 or 8 ft. past the spud foot, were tied together on the top and bottom by 6 x 8-in. timbers. Two timbers of the same size were butted up against each side of the spud foot and bolted to the logs. This arrangement allowed the operator to disengage the spud and place it in the ditch if desired.

In operation, the dredge was taken down one side of the ditch a distance of about half a mile, moving about half of the material in the section and placing all of it on the waste bank on that side. The dredge was then brought back to the beginning of the cut and the logs bolted to the spud next the first-deposited waste bank. With the lengthened spud on that side of the dredge, it was possible to set the dredge over to the other side of the ditch and dig it out, leaving the required width of berm. The time required to attach the logs was only a few minutes. Their use accomplished the same results as the installation of a new boom from 20 to 25 ft. longer than the old one.

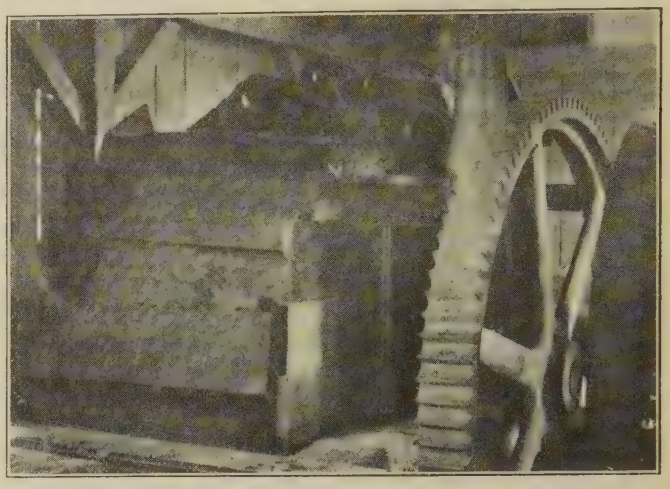
R. H. & G. A. McWilliams were contractors for the section described.

LOG BRIDGE SUPPORTING LOWER END OF SPUD ENABLED DREDGE TO DIG WIDE SECTION AND LEAVE REQUIRED 10-FOOT BERM AT SIDE

Cast Concrete Pulley Made When Cast-Iron One Breaks

By H. S. CARPENTER
Cobleskill, N. Y.

A BROKEN cast-iron pulley was recently repaired in the course of the writer's work by pouring it full of concrete. The pulley, which is one of the pair carrying the main elevator in a large stone-crushing plant, is 54 in. in diameter with a 20-in. face. In the failure,



CAST-IRON PULLEY TURNED INTO CAST CONCRETE

nearly the entire rim was broken out. An extra pulley was not available, and it took some time to secure a new one. To avoid shutting down the plant in the meantime, a form was built in place around the remains of the old pulley, using perforated metal faced with building paper for the rim and wood for the sides. The belt was left in place and the whole interior of the form poured full of 1:2:3 concrete. The upper part of the form, partly removed, is shown in the photograph.

Pouring was fininshed at 6 p. m. on Saturday and the concrete pulley was put in service at 11 a. m. the following Monday. The job was a complete success. The belt runs directly on the concrete.

To Relieve Counties of Road Maintenance

When a county road has been brought to the required width, grade and finish, it can be turned over to the state and thereafter the county will not have to expend money on its maintenance. The sooner a county road is developed, the sooner it can be taken over by the state and the county relieved of further expense. That is the feature of the proposed legislation which will be introduced in the Oregon state legislature at its next session.

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Consider Adoption of Pennsylvania Water Policy

Will Do Nothing Until Well-Ordered Plan Is Completed—Conservation Would Cost $100,000,000

First steps toward adopting a comprehensive and logical policy of water conservation for Pennsylvania were taken Jan. 3 when the first meeting of the Governor's Flood Control Committee was held in the office of Dr. Samuel G. Dixon, health commissioner. It was announced that an expert had estimated that if the state attempted to conserve all its waters and provide measures to control the floods of its 45,000 square miles of territory, as much as $100,000,000 would be required.

It was decided to ask for an appropriation of $50,000 to meet an equal amount furnished by the United States government toward the completion of the topographical and geographical survey of the state. In addition to this, and to supplement it, the committee will have drafted by its counsel a bill which provides for making a comprehensive survey of all the waters of the state. Upon this will be based a plan for the administration of the state's water resources. An appropriation of $200,000 will be requested with which to make the stream survey, which will be put under the control of the water-supply commission.

Will Not Rush Work

It is the unanimous opinion of the members that every effort should be made to avoid the mistake of rushing into water conservation legislation before a logical plan had been developed which would meet all conditions in the state.

"What we want to emphasize," said Dr. Dixon, "is that we are seeking a well-thought-out plan and that we hope not to take any step before we have the whole well-ordered scheme in view. It will take probably at least two years to make the detailed observations we need. That will provide a map showing location, condition, improvements, present use and legal status of the streams throughout the state, as well as other things necessary for the studies. This would also include such things as floods and we will know where they are likely to occur and how best to prevent the formation of conditions that lead to them."

Among the members who attended were Hon. Gifford Pinchot, Dr. Henry S. Drinker, Deputy Attorney-General Keller, John B. Eichenauer, George S. Webster, S. B. Elliott, J. A. Walls, E. W. Walker and Morris Knowles.

Hugh M. Wilson

Retires as Vice-President of McGraw Publishing Company Inc.

Hugh M. Wilson, first vice-president of the McGraw Publishing Company Inc., has tendered his resignation and will devote himself to his personal interests. Mr. Wilson has been vice-president of the company for the last six years. During that period the organization has grown constantly to greater strength. Two new papers, *Electrical Merchandising* and *The Contractor*, have been purchased, *Metallurgical & Chemical Engineering* has been changed from a monthly to a semi-monthly, while the other properties, *Electrical World*, *Electric Railway Journal* and, notably, the Engineering Record, have made rapid progress.

HUGH M. WILSON

Mr. Wilson has been in journalistic work during practically his entire business life. His first experience was as city editor of the Jacksonville (Ill.) *Daily Journal*. He subsequently was reporter on the Minneapolis *Evening Star*, but in 1889 made the change that determined his career. He joined the staff of the *Mississippi Valley Lumberman*, and with but one brief interruption since, has devoted his great energy and abilities to the one object of developing magazines in trade and technical lines. His progress with the *Lumberman* was rapid, but he soon changed his desk for another—this one in the office of the *Northwestern Railroader*, beginning then his connection with a field that came in a very few years to recognize him as one of its great leaders. He entered the staff as asso-

(*Continued on page* 80)

Saville Heads New England Waterworks Association

Chief Engineer of Hartford Water Department Elected President at Annual Meeting This Week

Caleb Mills Saville, who was elected president of the New England Waterworks Association at the annual meeting in Boston Jan. 10, was born in Melrose, Mass. He was graduated from Harvard College in 1889 with the degree of A.B. and a *cum laude* in engineering.

In 1890-91 he was assistant to M. M. Tidd, civil and hydraulic engineer, of Boston, and engaged on construction work on the Simpson drydock in Boston and on the design and construction of waterworks systems in various parts of the United States.

In 1891-95 he was engineer in charge of design and construction of the sewerage system in Malden, Mass. From 1895 to 1906 Mr. Saville was division engineer in the distribution department of the Metropolitan Water and Sewerage Board of Boston, having charge of numerous construction works of considerable magnitude, among which were the work incidental to building a storage reservoir at Spot Pond, the construction of the Forbes Hill reservoir, the driving of a tunnel under the Mystic River, and much work in connection with operation and maintenance.

Was on Panama Canal

In 1906-7 he was hydraulic engineer with French & Bryant, of Brookline, Mass., having in charge studies for several waterworks developments. From 1907 to 1912 Mr. Saville was connected with the Panama Canal, first as assistant division engineer in charge of construction work at Gatun. He made investigations for foundations and methods of construction for the Isthmian Canal dams, and later was appointed engineer in charge of the third division, office of the chief engineer. He made an unusually comprehensive study for the foundations of the Gatun dam. In his book, "The Panama Canal," F. J. Haskins states: The engineer who worked out the details of the engineering examinations of the Gatun dam in 1908 was Caleb M. Saville, who had had experience on some of the greatest dams in the world. Every engineer who has read Saville's report pronounces it a masterpiece of engineering investigation."

While in charge of the third division at Panama Mr. Saville had under his direction the hydrographic and meteorological work, general surveys and special investigations. For his paper on "The Hydrology of the Panama Canal"

he was awarded the Norman medal (1914) of the American Society of Civil Engineers.

In 1912 Mr. Saville resigned from the Panama Canal, having been invited by the Hartford (Conn.) Water Board to become its chief engineer, to take charge of its maintenance and operation work as well as the construction of the new additional supply. The latter work consists of the building of three large dams and reservoirs, eight miles of conduit, ½ mile of rock tunnel, and an extensive filtration plant.

The following vice-presidents were elected: Carleton E. Davis, chief of the Philadelphia bureau of water; Samuel E. Killam, superintendent of pipe lines and reservoirs, Boston; Henry V. Macksey, superintendent of public works, Woburn, Mass.; Frank A. Barbour, consulting engineer, Boston; Percy R. Sanders, superintendent of waterworks, Concord, N. H., and Thomas McKenzie, superintendent of waterworks, Westerly, R. I.

Elected President of New England Waterworks Association

CALEB MILLS SAVILLE

Willard Kent, of Narragansett Pier, R. I., was elected secretary; Lewis M. Bancroft, superintendent of waterworks, Reading, Mass., treasurer; Richard K. Hale, of Brookline, Mass., was made editor. The executive committee are William F. Sullivan, Frank J. Gifford and A. R. Hathaway.

Hearing on First Government Valuations Set for January 29

Monday, Jan. 29, has been fixed by the Interstate Commerce Commission as the date for the hearing on the valuations of the Atlanta, Birmingham & Atlantic Railway and subsidiaries, and the Texas Midland Railroad. The hearing will be held at Washington.

Hugh M. Wilson

(*Continued from page* 79)

ciate editor, but his business experience, the result of early training in his father's planing mill at Jacksonville, Ill., made him a valued adviser on the financial affairs of the paper. So keen was his business sense that when, within a year of his association with the *Northwestern Railroader*, it was consolidated with the *Railway Age*, at Chicago, he was made secretary-treasurer of the new organization.

Again his dual training—in business affairs and in editorial work—showed itself, for while he had a heavy load of business responsibilities, he found time to do much editorial work, particularly on news matters relating to the purchase of equipment and supplies. His familiarity with this branch of railroad work soon made him an authority and fitted him for the yeoman work he did as secretary of the Railway Supply Manufacturers' Association, which position he held from 1893 to 1897 inclusive. He subsequently became manager of the *Railway Age*, meanwhile continuing as secretary-treasurer. He was elected president of the company in 1899.

His tireless energy, vision and editorial grasp were never better displayed than by the publication during the International Railway Congress at Washington, in 1905, of a daily edition of the *Railway Age*, which was designated as the official journal of the congress. Supplementing the praise showered on him by both American and foreign delegates for the success of this enterprise, he was created a chevalier of the Order of Leopold by the King of the Belgians.

In 1906 the Wilson Company, with Mr. Wilson as the controlling owner, was organized, taking over the publication of the *Railway Age* and of the *Electric Railway Review*, which had just then been purchased and which was changed shortly from a monthly to a weekly publication.

Two years later Mr. Wilson sold both papers. The *Railway Age* was consolidated with the *Railroad Gazette*, while the McGraw Publishing Company purchased the *Electric Railway Review* and consolidated it with the *Street Railway Journal* under the name of the *Electric Railway Journal*.

Mr. Wilson immediately went abroad for an extended trip, and on his return in June, 1909, was elected director and vice-president of the Barney & Smith Car Company of Dayton, Ohio. His return was made the occasion of an elaborate dinner in his honor by the railway supply manufacturers and the presentation to him of a memorial setting forth the value of his services to the railroad industry during his presidency and editorship of the *Railway Age*.

Mr. Wilson continued with the Barney & Smith Car Company until 1910, and was then elected first vice-president of the McGraw Publishing Company, which position he now relinquishes. Mr. Wilson's strength as a publisher and his success in building up strong technical magazines have been due to his ability to sense the trend of events and to keep before him meanwhile certain clear ideals as to the place of the magazine in its industry or profession. He never faltered in his presentation of the truth when the speaking of the truth was timely and would be productive of good. Frequently that course offended powerful interests, who were unable to see, as he saw it, that the ultimate good of all could be served only by such a course. But that never caused him to hesitate. His influence not only on the journals with which he was connected but on the whole field of trade and technical journalism will be a lasting one.

Mr. Wilson's home address is Hartsdale, N. Y.

Illinois Highway Superintendents Meet January 18 and 19

The annual meeting of the Illinois Association of County Superintendents of Highways will be held Jan. 18 and 19 at the University of Illinois. The first day will be devoted to election of officers, the second to new business. Amendments to the Tice law will probably be suggested. The short courses in highway engineering will also be held on these dates.

Forest Money Allotted

Allotment to the various states of the $1,000,000 to be spent in the next fiscal year in constructing roads and trails in national forests was announced Jan. 6 by the Secretary of Agriculture as follows:

Alaska, $46,354; Arizona, $48,604; Arkansas, $9,803; California, $140,988; Colorado, $62,575; Idaho, $108,730; Montana, $7,042; Nevada, $19,296; New Mexico, $42,495; Oregon, $128,111; South Dakota, $8,092; Utah, $41,167; Washington, $91,904; Wyoming, $40,684, and a total of $9,995 to Florida, Michigan, Minnesota, Nebraska, North Dakota and Oklahoma.

Ohio River Bridge Must Be Reconstructed

The Supreme Court on Jan. 8 sustained the previous decision of the U. S. District Court requiring the Louisville Bridge Company at its own expense to reconstruct the Ohio River bridge at Ohio Falls in accordance with the ruling of the War Department. The injunction prohibiting reconstruction, which has been underway for some months, from proceeding except as required by the government order, was affirmed. The bridge must therefore be rebuilt with a clear channel span of 600 ft. over the "Indiana Chute," and the existing swing span across the Louisville and Portland Canal must be changed to a lift span giving horizontal clearance of 200 ft. and vertical clearance of 78 ft. The estimated cost is given as $400,000. The requirement was upheld as within federal authority under police power to prevent unreasonable obstruction to free navigation.

Western Society Honors George Washington as an Engineer

Honor to George Washington as an engineer is the idea of the Western Society of Engineers in naming the award founded by John W. Alvord for promoting the public good "the Washington award." Many structures still exist which the first President built as an engineer, and as he was pre-eminently devoted to promoting the public good the appropriateness of the title should be apparent, said B. E. Grant, the retiring president of the society at the annual meeting and dinner, held Jan. 10, in announcing the terms of the award.

Professional unity is to receive one more boost because of this award, for the membership of the committee is not to be restricted to the one society. The national societies of civil, mechanical, electrical and mining engineers have been asked to select two members each to act with nine from the Western Society of Engineers. A large membership was chosen for the purpose of keeping in touch with the widest possible range of engineering activities.

The Chanute medals for the best papers by members were awarded to Col. C. McD. Townsend, Corps of Engineers U. S. A., for a paper on "Currents of Lake Michigan and Their Influence on the Climate of the Adjoining States," and to Wilbur M. Wilson, assistant professor of structural engineering, University of Illinois, for a paper on "Wind Stresses in Steel-Frame Office Buildings."

The sensation of the evening was a mock trial of one Arthur J. Hennebik, charged with practising structural engineering without a license in that he designed a certain mausoleum in violation of the state law. The sketch was written by Benjamin Wilk.

An excursion provided by the Illinois Central Railroad was made Jan. 11 to the Pullman car works and the Illinois Steel Company's plant.

The results of the election of officers are as follows: President, H. J. Burt; vice-presidents, D. W. Roper, J. N. Hatch and W. W. DeBerard; treasurer, C. R. Dart, and trustee, O. F. Dahlstrom.

Reclamation Engineers Will Convene January 22

U. S. Reclamation Service engineers from the operation and maintenance departments of the Rio Grande, Hondo and Carlsbad projects in New Mexico, the Salt River valley and Yuma projects in Arizona, and the private irrigation projects of southern California, will meet Jan. 22, 23 and 24 at Phoenix, Ariz., for the annual conference on maintenance and operation problems. Special emphasis will be placed on the subjects of drainage and cleaning of canals. One of the three days will be devoted to an inspection of the Salt River project, and possibly the meeting will conclude with a trip to the Roosevelt dam.

Washington Residents Must Use Water or Lose It

Projected Legislation Would Terminate Friction Between Riparian-Rights People and Users

A bill to eliminate the long conflict between water users and those who have insisted upon full riparian rights in the state of Washington, in the sense of acquiring rights in a stream and preventing its use, is now being circulated among newspapers, interested citizens and public officials. The keynote of the bill is that a man must use the water to which he claims a right in order to retain that right. Use is held to be the essence of the property owner's right in a stream, and this he will ultimately lose if he does not use the water. If enacted into law, the bill will prevent acquisition of a riparian right and holding it purely for speculation.

Creates State Hydraulic Engineer

This water code was adopted by the Water Code Conference called by Governor Lister at Tacoma, July 11 and 12, 1916, and adjourned to North Yakima Nov. 15, 1916. The principal contest in the conference was between the riparian-rights representatives and the irrigationists. This conflict is disposed of by the water code, which fixes a limit of time within which a person claiming riparian rights must exercise them. The code provides for a state hydraulic engineer and gives him liberal authority to settle water controversies. All applicants for water rights must apply to the state hydraulic engineer.

O. L. Waller, professor of mathematics and civil engineering at the State College of Washington, is chairman of the water code committee.

President Would End "Pork"

President Wilson, in a conference Jan. 3 with Chairman Sparkman of the House Rivers and Harbors Committee, said he was opposed to the present method of appropriations and believed expenditures of that nature should be administered by commissions. Chairman Sparkman promised to include in the Rivers and Harbors bill of the present session a provision for creating such a commission. It is thought that the President will also insist upon a commission to administer funds for public buildings.

The President said that he desired to systematize the appropriations for rivers and harbors, flood control, irrigation and reclamation. This could best be done, he thought, through a commission which would thoroughly study the problems and work out a system under which present haphazard methods of appropriation would not prevail. The President's plan will deprive Congress of its time-honored privilege of designating particular improvements.

McGraw Company Buys Two Contracting Papers

Consolidated Publication Will Be Issued at Chicago Under Direction of Engineering Record Staff

The McGraw Publishing Company Inc. has purchased the *Contractor* and the *Contractor's Review*, both of Chicago, and will consolidate them under the name of the *Contractor*.

The new paper will continue to devote itself to the interests of the contractor engaged chiefly in local work and of the contractor's superintendent. It will be published at Chicago every other week, and the subscription price will be $1 a year.

The editorial and advertising policies will be directed by the staff of the Engineering Record, with E. J. Mehren, editor of the Engineering Record, as editorial director and C. S. Hill as acting editor. Mr. Hill has been the editor of the *Contractor's Review* and was formerly managing editor of *Engineering and Contracting* and associate editor of *Engineering News*.

Niagara Water Bill Passed

The House on Jan. 4 passed the Wadsworth bill, authorizing the Secretary of War to grant to waterpower users the entire 20,000 sec.-ft. of water divertible by the United States from the Niagara River under a Canadian treaty. The bill has passed the Senate and will go to conference so the amendments may be straightened out.

New Smoke Ordinance for Denver

A new smoke ordinance under consideration in Denver provides for the appointment by the Mayor of a commission of five members, three of whom would be engineers. The commission would act in an advisory capacity to the smoke inspector, obtain the cooperation of property owners, make rules and regulations for smoke inspection, and pass upon all applications for the installation or remodeling of power or heating apparatus. Penalties are provided for smoke of greater density than that specified. It also provides for a deputy smoke inspector at $2,400 per year, who shall have a technical training.

The report, of which the ordinance is the result, is the work of the smoke-abatement committee of the Denver Civic and Commercial Association. Frank E. Shepard is chairman. The other members are C. S. Pearce, Henry Read, Lewis Skinner and W. W. Case, Jr.

Want Topographer in Seattle

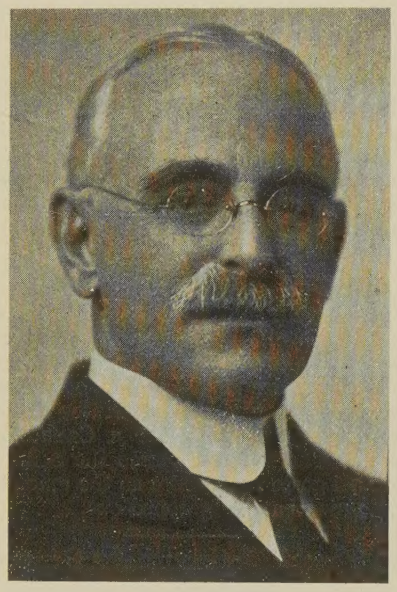
A topographical engineer is wanted by the Seattle school board to lay out school grounds and make the necessary elevations for all new school buildings, so that they will comply with aesthetic standards. The engineer selected will rank as consulting assistant to the school architect.

Henry Goldmark Made Member of Canal Board

Succeeds to Office on New York Barge Canal Made Vacant by Death of Dr. Corthell

Henry Goldmark, consulting engineer, of New York City, was recently appointed a member of the board of consulting engineers for the New York Barge Canal. His appointment fills the vacancy caused by the death of Dr. Elmer L. Corthell. Mr. Goldmark has

Appointed to Succeed Dr. Corthell on Barge Canal Board



HENRY GOLDMARK

engaged in private practice in New York since 1914, at which time he resigned as designing engineer for the Isthmian Canal Commission. Among his recent undertakings is the design of equipment for a dock at Chemulpo, Korea, an article on which appeared in the Engineering Record of Dec. 12, 1916, page 684.

After graduation from Harvard University in 1878, Mr. Goldmark spent two years studying at the Royal Polytechnic Institute at Hanover, Germany. His first engineering work was on the Erie Railroad in 1880. From 1882 to 1896 he was engaged mainly on bridge construction for various railroads. During 1882 and 1883 Mr. Goldmark was engineer in the bridge department of the West Shore Railroad under Albert Lucius, and from 1887 to 1891 engineer of bridges for the Kansas City, Fort Scott & Memphis system. He also made special reports on all existing bridges for various railroads, including the Boston & Maine and branches of the Santa Fe system. His efforts in 1892 and 1893 were devoted to designs of World's Fair buildings at Chicago, and much miscellaneous work.

The Pioneer Power Plant of Utah, one of the very first of the large hydroelectric installations in the United States, was designed by Mr. Goldmark in 1896 and 1897. He also made plans for the late George S. Morison of the large concrete viaduct which carries Connecticut Avenue over the Rock Creek Valley at Washington, D. C. The years 1897 to 1900 he spent in charge of lock-gate design for the U. S. board of engineers for deep waterways, including what was considered by the late Alfred Noble the most complete general study of lock-gate design that has yet been made.

In 1901 Mr. Goldmark was made resident engineer for George S. Morison on the erection of a railroad bridge across the Missouri River at Atchison, Kan. This was the last work of that noted engineer. For the next five years Mr. Goldmark was engineer in charge of the design and construction of the large locomotive and car shops for the Canadian Pacific Railway at Montreal and Winnipeg, and of the new works of the Canadian Locomotive Company at Kingston.

From 1906 until 1914 he was designing engineer for the Isthmian Canal Commission in charge of the plans and construction of the lock gates, chain fenders, caissons, a floating railroad bridge and various other works on the Panama Canal.

Cable Supporting Concrete Chute Parts, Toppling Two Towers

A 1-in. cable supporting a concrete chute became so badly worn at the point where it passed over the oak support that it parted Jan. 2 and caused the collapse of a chute and two concrete towers being used in the construction of a building for the American Can Company at Maywood, Ill.

At first it was thought that the accident was due to a defective cable, but close examination, state the contractors, indicates that the cable was worn through where it passed over a 4 x 12 in. oak head block at the top of the concrete tower. Subsequent tests showed the cable was able to withstand twelve times the load carried. The chute fell across guys for this tower, which, in toppling over, fell on guys supporting a tall 210 ft. tower. The tall tower did not fall full length, but collapsed vertically, the guys holding it in this position.

Announce Nominees for American Concrete Institute Offices

The nominees for office in the American Concrete Institute are as follows: President, Prof. W. K. Hatt, of Purdue University; vice-president, Sanford E. Thompson, consulting engineer, Boston; treasurer, Robert W. Lesley of Philadelphia. The nominees for directors are: Ernest Ashton, chemical engineer, Lehigh Portland Cement Company; W. P. Anderson, president, Ferro-Concrete Construction Company, and E. M. McCullough, chief engineer, fireproof construction bureau, Portland Cement Association.

Engineering Society Activities

Municipal Engineers of the City of New York will hold their annual meeting Jan. 24 in the Engineering Societies Building. After a short business session there will be musical numbers and a dance. Admission will be by card only.

Engineers' Society of Western Pennsylvania met Jan. 9 to hear Horace R. Thayer, assistant professor of structural design, Carnegie Institute of Technology, tell of historic failures of masonry structures.

Associated Technical Societies of Baltimore has been formed to effect "a closer relation between the various organized bodies of technical men." The initial membership is about 500.

Engineers' Club of Cincinnati has elected the following officers for the ensuing year: Prof. A. M. Wilson, University of Cincinnati, president; A. E. Robinson, superintendent of the American Tool Works Company, vice-president; E. A. Gast, Hamilton County bridge engineer, secretary and treasurer; directors, E. A. Muller, mechanical engineer of the King Machine Tool Company, O. F. Shepard, Jr., electrical engineer, Warner Elevator Company, and Prof. G. M. Brown, of the University of Cincinnati.

Indiana Engineering Society will hold its annual convention Jan. 18, 19 and 20 at Purdue University. At the first session, beginning in the afternoon, Prof. F. H. Newell and Gen. Anson Mills are scheduled for addresses. The banquet is to be held Friday evening; municipal engineering subjects will be discussed Saturday morning.

Colorado Association of Members of the American Society of Civil Engineers will hear this evening M. S. Ketchum, dean of the College of Engineering, University of Colorado, discuss "The Design of Highway Bridges." Recent practice is to be outlined of live loads, types of structures, bridge floors and width of roadways.

North Dakota Society of Engineers will hold its annual convention Jan. 30 and 31 at Bismarck. F. E. Chandler, secretary, states that practically every kind of engineering, from mining to municipal, is to be covered.

Iowa County Engineers' road school and convention will be held at Ames Feb. 27, 28 and March 1. The formal program will be brief, most of the time being available for discussion.

Oklahoma Society of Engineers at its annual meeting Dec. 27 and 28 elected the following officers: President, Alfred Boyd, dean of engineering, A. & M. College; vice-presidents, Max L. Cunningham, state engineer; Frank B. King, U. S. Corps of Engineers, and T. P. Clonts, county engineer, Muskogee; secretary-treasurer, H. V. Hinckley, consulting engineer, Oklahoma City.

Lieut.-Col. Chester Harding New Governor of Panama

Has Been Acting Governor in Absence of General Goethals—On Canal Work Since Late in 1914

Lieut.-Col. Chester Harding, Corps of Engineers, U. S. A., who was in 1914 appointed engineer of maintenance of the Panama Canal, has been made governor of the Panama Canal Zone to succeed General Goethals. The appointment, made by President Wilson, will probably be approved by the Senate soon. During the last few years Colonel Harding has been receiving training and experience that would fit him for the office for which he has been selected. In the absence of General Goethals he has been acting governor.

Chester Harding was born in 1866 at Enterprise, Miss. He was graduated from the University of Alabama in 1884 and from the U. S. Military Academy in 1889. After three years in the graduate school at Willetts Point, N. Y., he was sent to Chicago to work on river and harbor improvements. That was followed in 1894 by his appointment to duty on the Mississippi River. After two years on that work Colonel Harding was made instructor at the Military Academy. He was advanced to the rank of captain in 1898 and put in charge of the torpedo defense of Narragansett Bay. The following year he was transferred to duty on the shores of Lake Michigan.

His appointment as assistant to the engineer commission of the District of Columbia, in charge of the sewer, water and building departments, came in 1901. In 1906 he was made a major, and later in that year was appointed engineer commissioner of the district. Late in 1914 Colonel Harding was transferred to the Panama Canal as engineer of maintenance in the permanent government of the Canal Zone.

Has Been Appointed Governor of Panama Canal

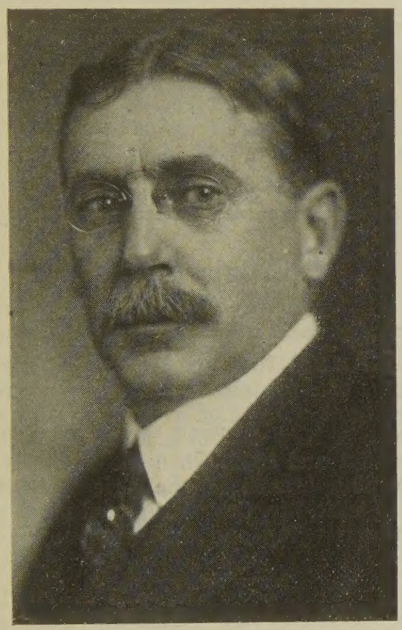


Photo by Harris & Ewing, Washington

LIEUT.-COL. CHESTER HARDING

What Engineers and Contractors Are Doing

RICHARD R. ROSE has resigned as estimator for the Ferguson Steel & Iron Company, of Buffalo, to join the forces of the Riter-Conley Manufacturing Company at Pittsburgh. Mr. Rose is a graduate of the School of Architecture at Carnegie Institute of Technology.

HENRY WELLES DURHAM recently resigned as county engineer of Bergen County, New Jersey, and will devote all of his time to his private practice at 366 Fifth Avenue, New York City. Mr. Durham was appointed county engineer in January, 1916. He has been carrying on consulting practice since June, 1915, when he resigned as chief engineer of the Bureau of Highways, Borough of Manhattan, New York City, which position he had held for about three years. Mr. Durham was graduated in 1895 with the degree of C. E. from the School of Mines of Columbia University. He has been prominently identified with engineering work in New York City, on the Nicaragua and Cape Cod Canals and in Panama City.

CLARENCE E. RAYNOR, for the last 9 years assistant engineer on the Ashokan reservoir, has resigned to enter the valuation department of the Seaboard Air Line Railway, with office at Norfolk, Va. Mr. Raynor's work for the New York Board of Water Supply is now finished, which is the reason for his change.

W. D. WILKINSON has been retained by the city engineer of Pasadena, Cal., to work on an experimental sewage-disposal plant using the activated-sludge method. He was recently employed by Arthur R. Kelley on the valuation of the Southern California Edison Company's properties and those of the Great Western Power Company in San Francisco.

GUY F. HOSMER has severed his connection with O. Perry Sarle of Providence, R. I., to become engineer for the Maine Coated Paper Company, with office in Rumford, Me. Mr. Hosmer has been associated with Mr. Sarle since 1895 on all kinds of engineering work in the East.

ALBERT W. NEWTON, formerly assistant to the president of the Chicago, Burlington & Quincy Railroad, has been appointed chief engineer, with headquarters at Chicago, to succeed T. E. Calvert, deceased. Mr. Newton was engaged in general engineering practice from 1892 to 1898, and the following two years was engineer of the Sny Island levee and drainage district, with headquarters at Pittsfield, Ill. His first railroad experience was with the Chicago & Alton Railroad from 1900 to 1903, during its reconstruction period. Mr. Newton was employed as assistant engineer, with headquarters first at Kansas City, and later at Bloomington, Ill. On March 15, 1903, he first entered the service of the Burlington as construction engineer at St. Louis, in charge of the Old Monroe (Mo.) to Mexico extension. On Oct. 1, 1904, he was appointed assistant engineer, with office at Chicago, and on Dec. 1 of the same year returned to St. Louis as engineer of the Missouri district. He became general inspector of permanent way and structures in the office of the vice-president, with headquarters at Chicago, Jan. 1, 1907. With the exception of a short period between Nov. 1, 1908, and Feb. 5, 1909, when he was temporarily division superintendent at Creston, Iowa, Mr. Newton continued in that position until Jan. 1, 1915. Jan. 1, 1914, he was appointed chairman of the federal valuation committee of the Burlington, and in connection with these duties became chairman of the engineering committee on the Western Group, Presidents' Conference Committee on federal valuation, both of which positions he still retains. His appointment as assistant to the president, with headquarters at Chicago, became effective Jan. 1, 1915.

New Chief Engineer of Burlington Railroad

ALBERT W. NEWTON

B. S. REMINGTON has been engaged as assistant engineer on the Chandler (Ariz.) irrigation project, for which Quinton, Code & Hill of Los Angeles are consulting engineers. The work, involving an expenditure of $500,000, has been contracted for. Mr.

Remington was graduated at Ames, Iowa, in 1907. His first work was as rodman on construction for the Chicago, Milwaukee & St. Paul Railway in Montana. After working for various roads, he was made assistant engineer for the Canadian Northern Railway. For five years he had charge of the $2,000,000 revision across Rainy Lakes, Ontario. For the last two years Mr. Remington has been employed on paving work in California.

HORACE DUNAWAY, formerly topographer with the U. S. Geological Survey, and later junior engineer in the U. S. Engineer's office at St. Paul, has again taken up engineering work after a two-year period of poor health. He has opened an office at Elbow Lake, Minn., as drainage engineer.

W. H. SCALES, secretary and chief engineer for the Blackhawk Construction Company, of Waterloo, Iowa, has been elected a vice-president of the firm. He is at present in Fort Worth, Tex., on a two-month leave of absence.

CLARENCE W. HUBBELL, consulting engineer, of Detroit, has been appointed city engineer to succeed R. H. McCormick.

H. B. SCHELLHOUS, formerly chief engineer of the proposed Lafayette & Northwestern interurban railroad, has opened an office for general engineering in partnership with F. J. Herring at Forest City, Ark. Recently Mr. Schellhous was employed on valuation work with the People's Gas Light & Coke, Company, Chicago.

MOULTON ENGINEERING CORPORATION, of Portland, Me., has opened a New York office in the Woolworth Building, in charge of Horace W. Flashman, who has been associated with the Westinghouse Electric & Manufacturing Company for a number of years. The facilities of the home office are also being extended.

J. L. STEPHENS, for the last five years assistant city engineer of Mishawaka, Ind., has been appointed city engineer to succeed C. W. Cole.

C. W. COLE has resigned as city engineer of Mishawaka, Ind., to open consulting offices in the J. M. S. Building, South Bend.

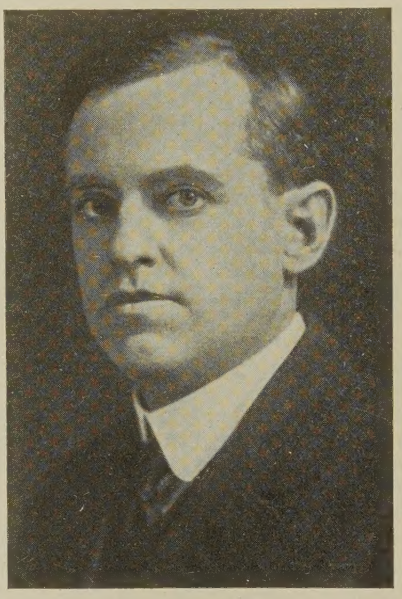
R. C. WHITE, formerly engineer maintenance of way of the Southern district of the Missouri Pacific Railway, has been appointed superintendent of the Memphis division, with headquarters at Wynne, Ark. He succeeds D. O. Onellet, who has been transferred to the Valley division, with office at McGehee, Ark.

DEGNON CONTRACTING COMPANY has located its main offices in the Queens Subway Building, Hunterspoint and Van Alst Avenues, Queens Borough, New York City.

S. CAMDEN MILLER has resigned as operating engineer for the Canton (Ohio) Bridge Company, to take effect the last of February. He has announced no plans for the future.

HENRY JACKSON BURT, civil engineer for Holabird & Roche, architects, Chicago, was elected, Jan. 5, president of the Western Society of Engineers. After graduation from the University of Illinois in 1896, his first work was on estimates in connection with a proposed belt line in Chicago. For two years he was employed in drafting, designing and estimating structural steel in the New Orleans office of the Gillette-Herzog Manufacturing Company, of Minneapolis. For a few months in 1899 he was resident engineer on construction work for the Chicago & North Western Railway,

New President of Western Society of Engineers, Chicago



HENRY JACKSON BURT

which was followed by employment on a track-elevation survey for the Chicago & Western Indiana Railroad in 1900. Then followed his incumbency of an assistant professorship in civil engineering at Iowa State College for a year. For ten years he was with the American Bridge Company, three years in charge of contracting, designing and estimating at the Salt Lake office and six years in charge of the Denver office. In 1911 he accepted the position he now holds. Mr. Burt is the author of a book on steel construction covering the design of steel framework for buildings. He has been active in all engineering societies in the cities where he was located. In Denver he, with H. S. Crocker, was largely instrumental in making a success of the Colorado Association of Members of the American Society of Civil Engineers. Mr. Burt was its first secretary and later its president. His services for the Western society as chairman of the committee on the structural engineers' license law accounts in a large measure for the popularity which has resulted in his election as president.

A. PEARSON HOOVER, formerly contracting engineer for the John W. Ferguson Company, of Paterson, N. J., is now associated with E. P. Goodrich, consulting engineer, of New York City. Mr. Hoover received his education at Roanoke College and Rensselaer Polytechnic Institute. During the two years that elapsed between his terms at these two institutions, he was employed by the engineering department of the Baltimore & Ohio Railroad. After leaving Rensselaer in 1905 he was appointed engineer for the Shaw Engineering & Manufacturing Company, New York City. Then followed work on various buildings, among which are the 11-story concrete structure built for the McGraw Publishing Company Inc., the American Woolen Building and the Pocono Building, in New York City. Since 1913 he has been associated with John W. Ferguson.

SHIRLEY BAKER, formerly construction engineer, E. E. Carpenter, formerly chief civil engineer, and William Waters, formerly superintendent of building construction for the Panama-Pacific International Exposition, have opened offices for the practice of general engineering under the firm name of Baker, Carpenter & Waters, in the Holbrook Building, San Francisco.

W. O. MCCLUSKEY, JR., has been appointed county road engineer of Ohio County, West Virginia, to succeed George W. Steenrod. Mr. Steenrod will not retire from office until February.

Obituary Notes

HENRY K. COOPER, civil engineer, of Springwater, N. Y., died recently at the age of 86 years. He was born in New Bedford, Mass., in 1830. In 1851 and 1852, when the Rochester-Corning branch of the Erie Railroad was built, Mr. Cooper directed much of the surveying and construction.

Civil Service Examinations

United States—Examinations will be held Feb. 6 for mechanical draftsman, salary $3.52 to $6 per day. Ask for form 1312. Examinations will be held Feb. 7 for sanitary engineer, salary $1,600. Applicants should fill in form B. I. A. 2. Other examinations on Feb. 7 are for electrical assistant, salary $1,200, and for junior physicist, salary $1,500. On Feb. 7 and 8 applicants will be examined for positions as mechanical laboratorian, salary $4.24 per day. Form 1312 should be filed by applicants for these positions.

Chicago—Examinations will be held Jan. 19 for rodman, salary $70 to $90 per month, for the West Chicago Park Commission. Applicants will be assembled in the Union Park Office.